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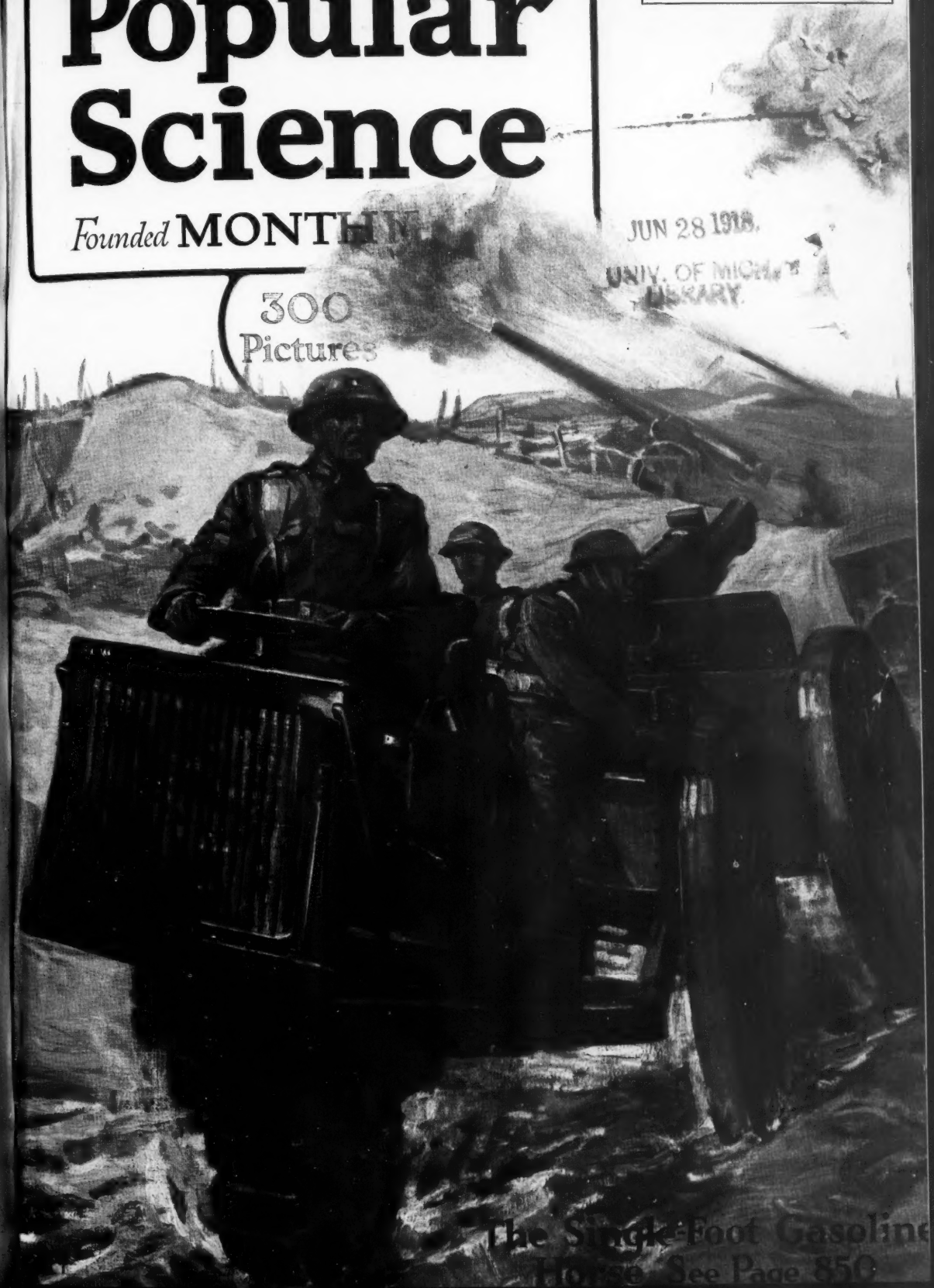

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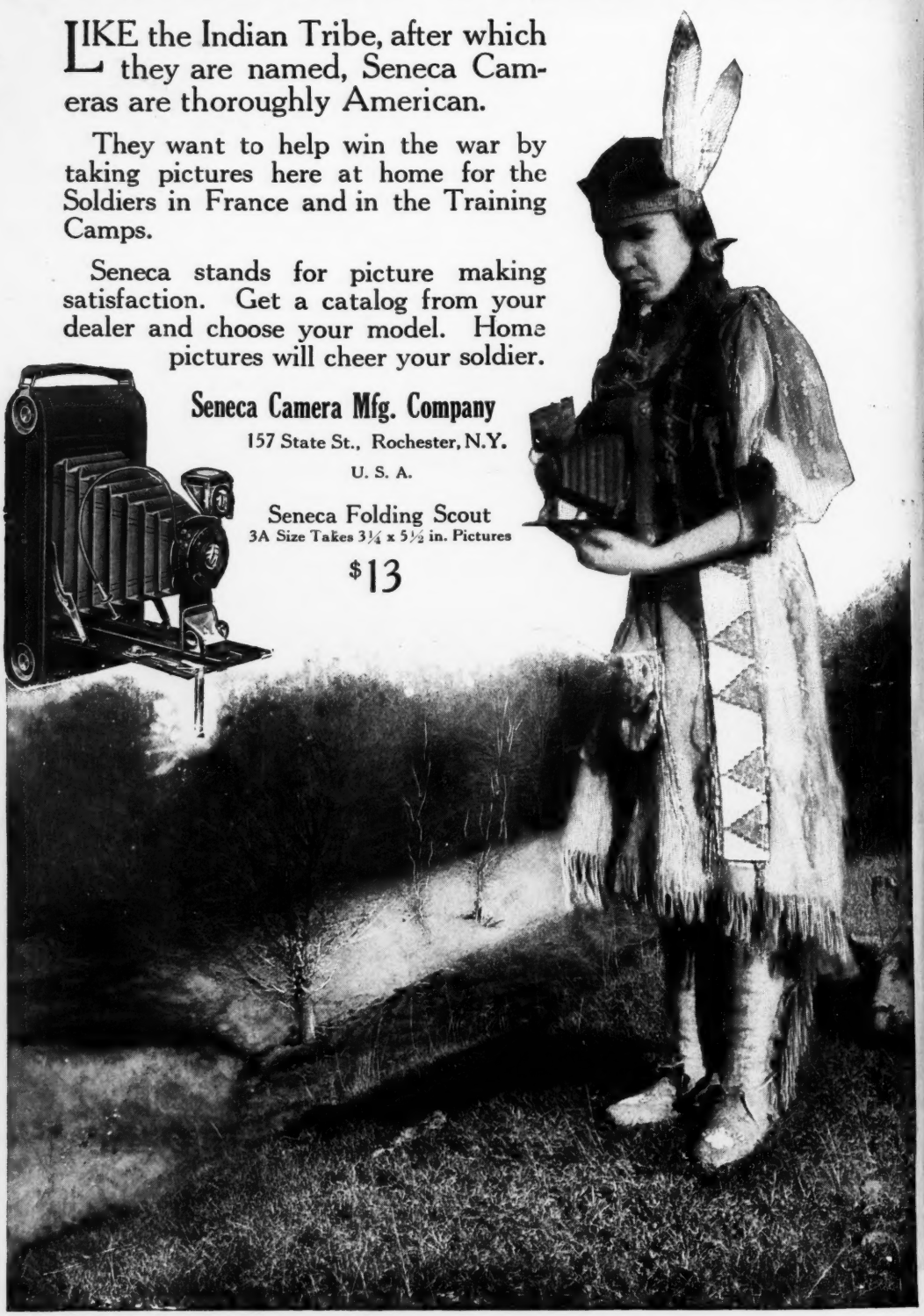

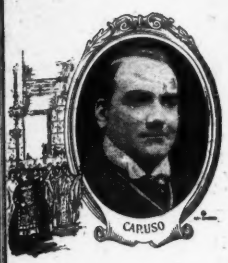

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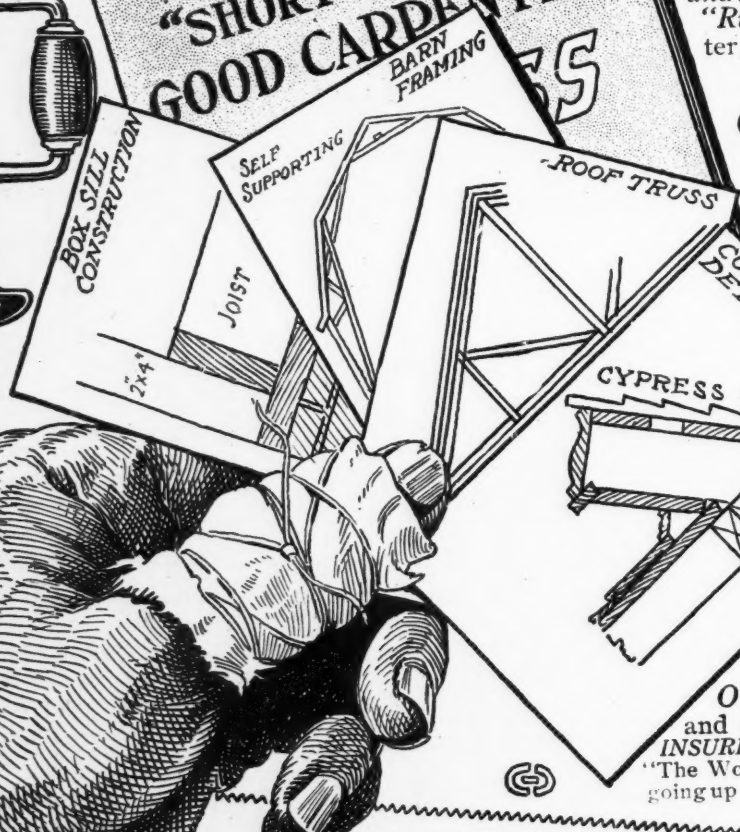

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POPULAR SCIENCE MONTHLY may be had at all news stands in the United States and Canada; also from the International News Company, Breams Bldg., Chancery Lane, London, E. C., and at Brentano's, 37 Avenue de l'Opéra, Paris.

Forms close the twentieth of the second month preceding date of publication. Advertising rates on application. Entered as second class matter at the New York Post Office, under the Act of Congress of March 3, 1879. Entered as second class matter at Post Office Department, Canada.

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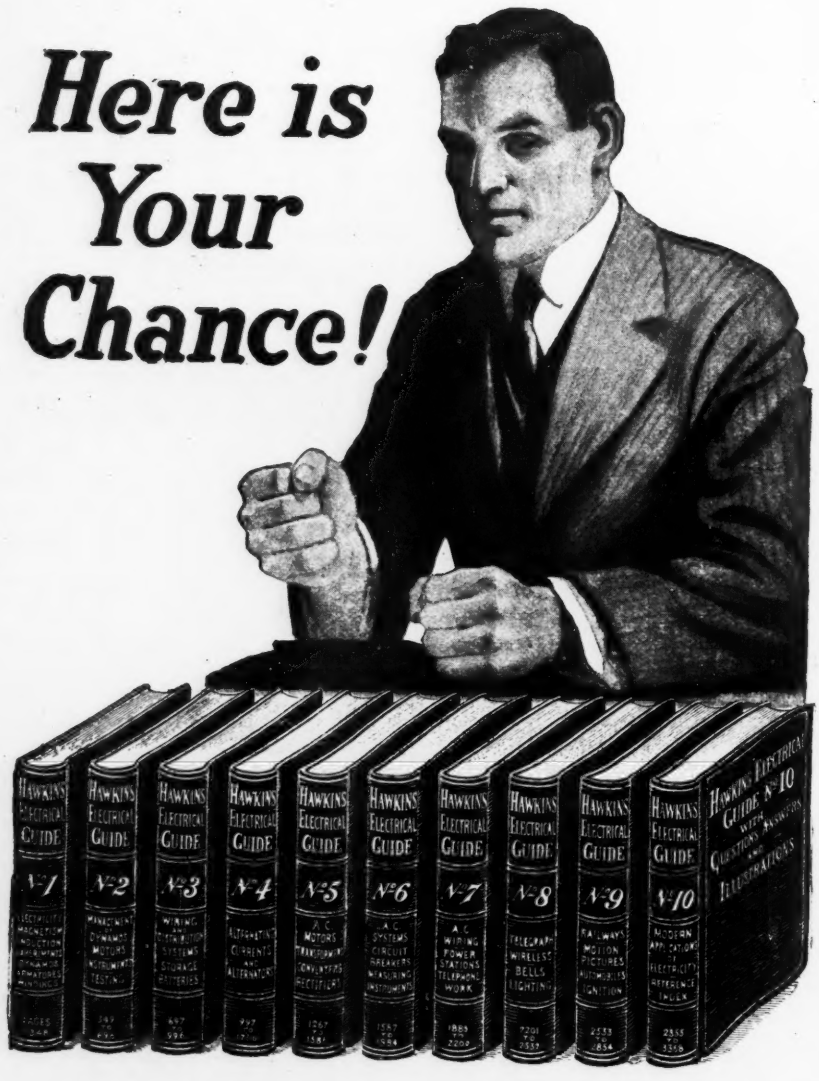

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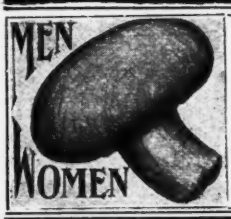

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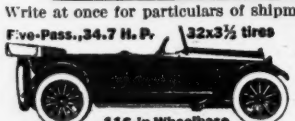

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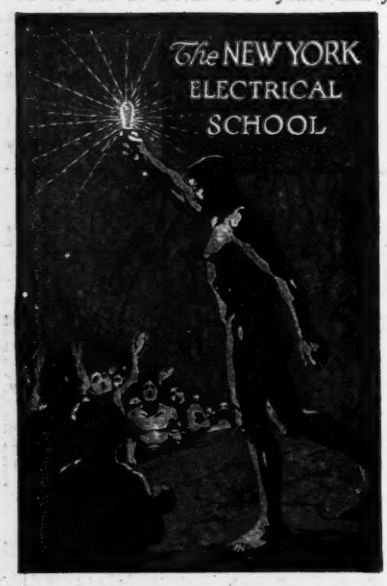

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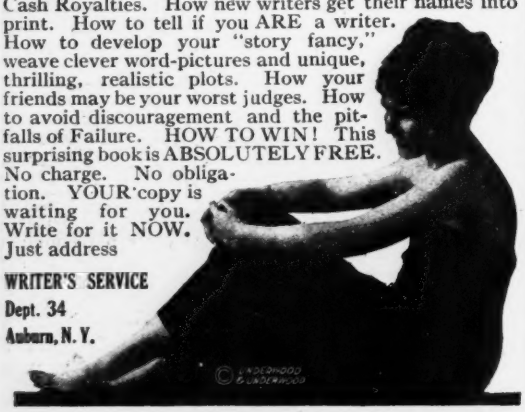

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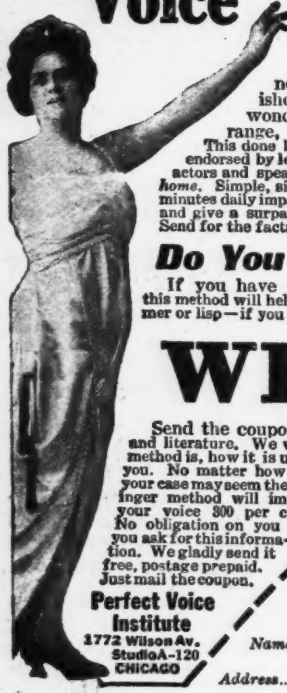

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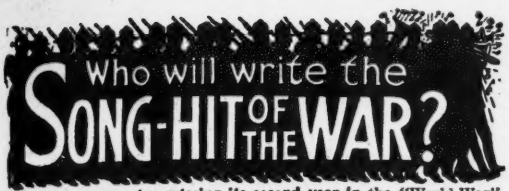

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Continued on Page 28

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Continued from Page 26

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MR. A. G. ZELLER, President,
Michigan State Auto School, Detroit, Michigan.

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We are ready to co-operate with you in the excellent work you are doing by giving your school all the data and information not only on tractors, but on conditions generally that can be used in developing thoroughly practical, efficient tractor operators and mechanics.

Your practice of co-operating with the factories is very commendable, for it brings together the biggest men and most successful ideas to be had. As you know, there is an urgent demand for tractor men who are trained and efficient. War has taken thousands of men from the farms and these men will have to be replaced, and thousands more will be needed to care for the big crop increases.

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Very truly yours,
INTERNATIONAL HARVESTER COMPANY OF AMERICA
Signed by F. W. Heiskell, Advertising Manager.

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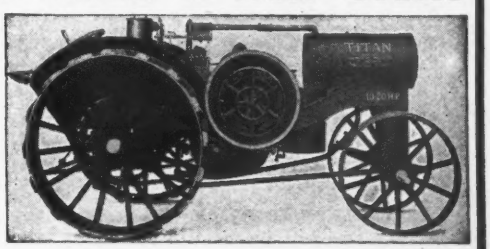

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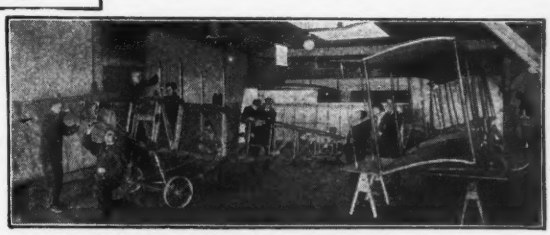

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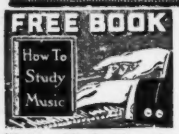

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Chicago San Francisco New York

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MR. JOHN A. TENNEY, President, National Aero Institute, Chicago, Ill. Detroit, Mich.

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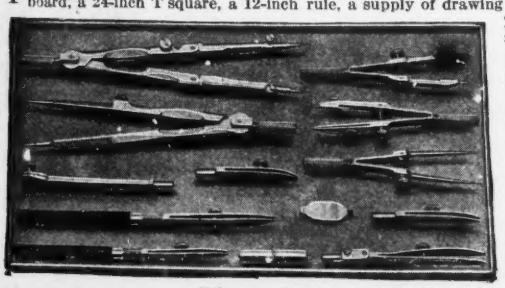

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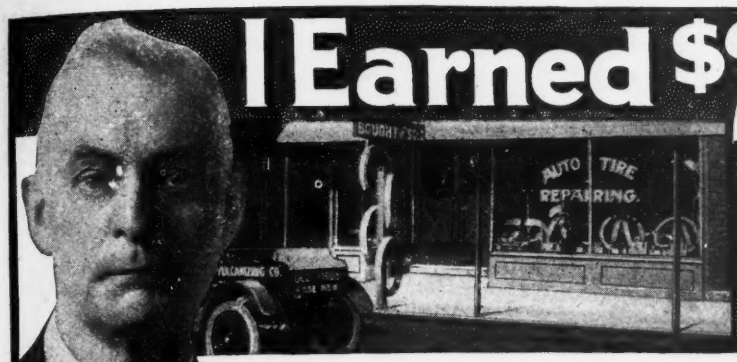

This is Richard A. Oldham

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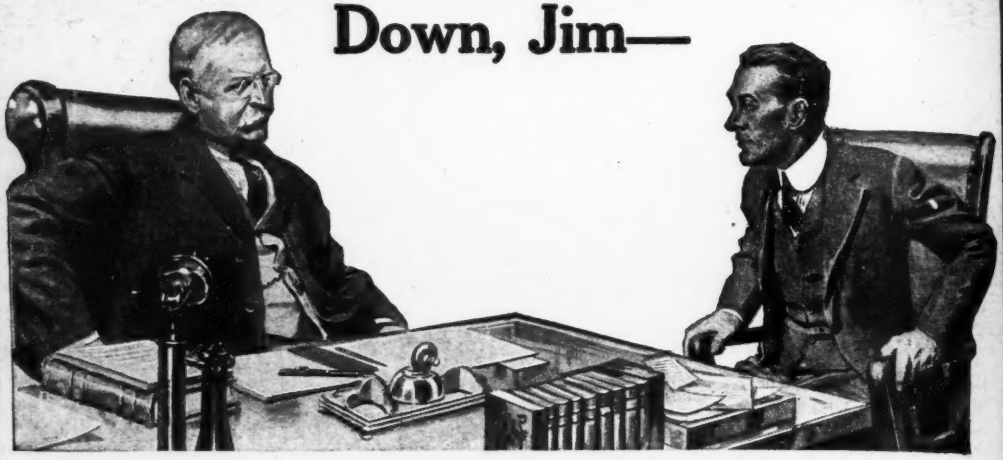

"You say that you've been with us several years and ought to have more money—that others have advanced while you stood still.

"There's a reason for everything, Jim, and in your case here it is: You've been short on headwork in your present job, and you haven't studied the job *ahead* of you at all.

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March 18, 1918

Editor, "Popular Science Monthly"
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Dear Sir:

We are just in receipt of a communication signed by the Camp Librarians at Camps MacArthur, Logan, Bowie, Travis, Pike, and Doniphan, stating that there is in these camps a demand for "Popular Science Monthly", which is far in excess of the copies received through the Burleson "one-cent" privilege. It is very desirable that more copies of "Popular Science Monthly" reach them promptly from the original subscribers. On behalf of the thousands of reading men whom they represent, they ask us "in some emphatic way" to place this matter before your subscribers and see if it is possible to get more copies of this magazine into the postoffice under the Burleson Act. The need is urgent.

There is an over-supply of some magazines, but an under-supply of yours. We are of the opinion that this need of a supply exists at many other camps, and we therefore hasten to call this matter to your attention.

Very truly yours,

Joseph L. Wheeler
Assistant to the Director

JLW:EJW

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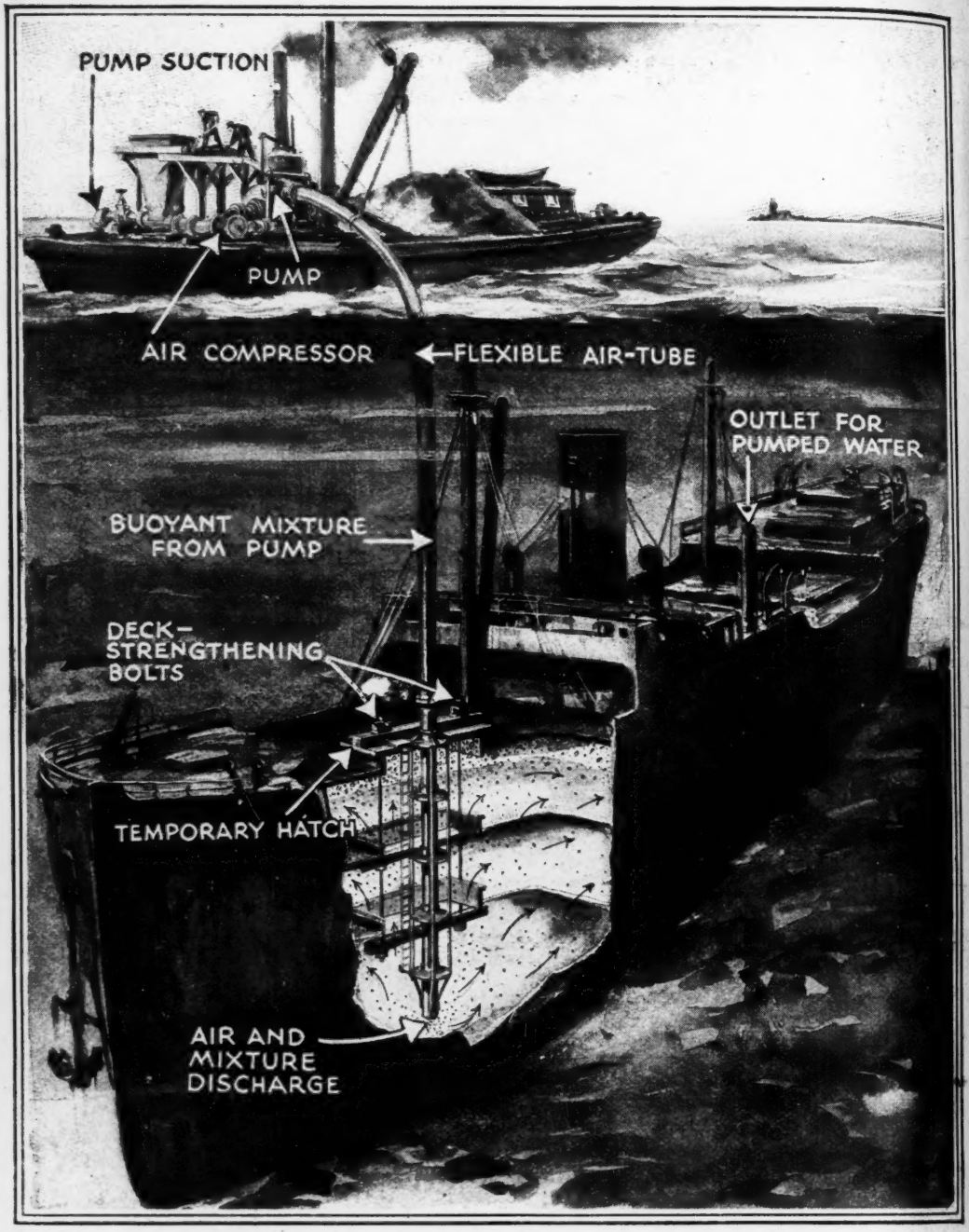
We receive letters such as this all the time. Please help the Camp Librarians to make it easier for our boys "over here" as well as "over there". When you have read your Popular Science Monthly, put a one cent stamp on it and drop it into the nearest post-office or mail box.

Editors of the Popular Science Monthly.

Salvaging Ships Sunk by Submarines



Raising a Hull by Pumping a Buoyant Mixture Into It

Salvage ships on the surface and section of sunken ship of usual cargo-carrying type below. Connection is made, extending through all three hatchways of the ship to its hold, by a flexible tube secured within another flexible tube and continued within a metal pipe coupled to the latter. The metal pipe is secured to a temporary hatch-cover, with manhole for the upper hatchway, and carries a ladder and working platforms for divers. The entire construction is further reinforced by brace rods wherever they are needed

The inner flexible tube is connected with a centrifugal pump in the salvage ship. A derrick supports the tubing. A suction pipe with a cut-off valve or seacock leads from the centrifugal pump to the open sea. It connects with a hopper that receives the buoyant material. The paraffin comes through a pipe from the paraffin tank where it is kept liquid and heated by a steam coil connected with the ship's boiler. An air pump is connected by a pipe to a space between the outer and the inner flexible tubing

Popular Science Monthly

225 West Thirty-ninth Street, New York City

Vol. 92
No. 6

June, 1918

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Raising a Sunken Ship with Cork

A way of salving valuable ships which have been torpedoed

By Simon Lake

SINCE the outbreak of the war several thousand ships, ranging in displacement from a few tons to thousands of tons, have been sunk by submarines, mines or shell fire. The loss of the ships and of their valuable cargoes is so great that it is keenly felt by the nations principally concerned. Long before the German submarine adopted the present policy of sinking all ships found within prescribed zones and thereby involving the United States in the war, I invented a method of salving vessels which may be applied after the treaty of peace is signed. Many of the ships sent to the bottom by the Germans are lost beyond all hope of recovery. They have been either too severely damaged by the explosions of mines or torpedoes, or they lie at depths too great to be reached by divers.

Mr. Simon Lake, the author of this article, is one of the pioneers in the development of the submarine. His reputation as an inventor and builder of submarines and his vast experience as an adviser on submarine questions to the United States Government as well as to the leading European Powers entitle the ingenious suggestions contained in this article to most careful consideration

But enough have found a resting place in water shallow enough to justify the use of the invention I am about to describe.

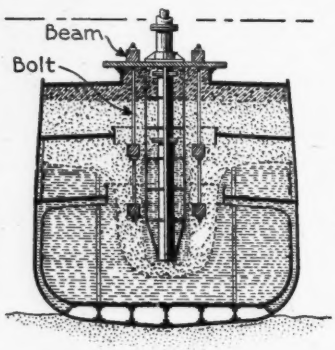
I do not believe strongly in pumping water out of a sunken ship, because it is nearly impossible to close all openings and prevent other water from running in to take its place. Then if they are at any considerable depth the water pressure will crush in their decks. To place chains under the ship and attach them to pontoons, from which the water is thereafter pumped out, is a ticklish job unless the waters are quiet and the sea bottom sandy. The use of many small air bags or casks placed under the decks by divers is costly and suitable only for small wooden vessels.

I suggest that the water be driven from the interior of the ship by forcing buoyant material in, which may be accomplished by centrifugal pumps pumping into the sunken vessel water mixed with cork or heated paraffin or both. The buoyancy of these materials eventually lifts the vessel, and the materials are gathered and used over again. As paraffin hardens when cooled, it does not escape through small rents or fissures in the decks; on the contrary, it tends to close them. Holes in the bottom of the ship do not interfere with this process. The buoyant materials, after being forced in, tend to spread in a gradually hardening and expanding layer under the decks, strengthen-

ing and preventing them from collapsing or lifting. If weakness is suspected or reported by the divers, a mixture of paraffin and small blocks of cork is used in preference to either of the materials alone, as it forms a stronger and more binding mass, extending as a beam from one side of the ship to the other. After the upper decks have been sealed in this manner, air can be pumped into the vessel to force more water out, either through a pipe provided for this purpose or through breaks in the bottom. In the case of torpedoed ships with large openings in the sides, considerable preliminary repair work by divers may be necessary to close the upper portions of the rents or to construct bulkheads extending far enough down.

The operation is readily understood by reference to the description under the accompanying illustration. When the seacock is opened, water rises in the hopper to the level of the sea. When now the centrifugal pump is started it pumps water into the sunken vessel. If there are no holes in it, an outlet for the surplus water is supplied by means of a pipe raised in the ship's bottom. The buoyant material—small blocks of cork or balsa wood boiled in paraffin—is now dumped into the hopper till its weight forces it to mix with the inflowing water, and it is thereby taken into the pump and forced down through the piping. Released at the lower end of the inner pipe it rises, but the water with which it is mixed, seeking the outlet provided for it in the other hatch, produces currents carrying the cork along, so that eventually it reaches all parts of the ship, rising the while against the decks. When a sufficient amount of this buoyant material has taken the place of water, the ship rises.

If the ship is too weak from prolonged corrosive action of the water, and the decks liable to lift, heated paraffin is run into the hopper with the cork. To prevent it from cooling and hardening too soon, air is pumped into the space between the inner and the outer tubing. Some air is allowed to be forced into the hold together with the cork and paraffin and helps to carry these substances toward leaks and sealing them.



How Decks and Hatches Are Secured

The upper deck of a sunken ship may be strengthened by hardened deposits of cork and paraffin under it. To secure the hatches, heavy beams are weighted and lowered into the hold and placed in position by divers. Next the weights are removed and the buoyancy of the beams holds them in position. Bolts are lowered and connected with the beams. Then a second set of beams is placed on top of the hatch and connected with the tie-bolts. This arrangement effectually distributes the strain on any one deck to all the decks of the ship

Lighting Up East India—How America Helps

INDIA is making slow but steady progress in introducing more modern lighting methods. All public lighting in the large cities of India is by electricity; but in smaller cities the methods of lighting, public as well as private, are still very primitive. The use of illuminating gas is extremely restricted and lamps in which petroleum or vegetable oils are burned are used to some extent, though not generally.

For native festivals—and there are a great many of these—large kerosene lamps of an elaborate pattern are much used. They are known in many localities as "Washington Lights" and were originally brought to India from the United States. At various religious processions and especially at wedding processions as many as twenty or thirty of these lamps are carried on the heads of bearers who are engaged for the occasion and paid a fixed fee.

These lamps are high-pressure kerosene lamps constructed upon the principle of the kerosene torches used in the United States. The light is protected by a mica chimney and is very brilliant. Colored globes are sometimes used. These lamps are no longer imported from the United States but are manufactured in Bombay. The "Bombay Lights" cost about five dollars or six dollars, while the imported kind can not be bought for less than sixty-five dollars apiece.

The Martyr Pigeon of the British Navy. He Saved Four Men

"WHERE in the world are we?" roars one of the observers in a huge biplane which is trying to make home after a run into a fog-bank, feared by all airmen. The raw biting air wraps around the four men in the machine, and nothing can be seen but blinding billows of fog. Darkness descends and they are still lost. There is a falter in the hitherto steady roar of the engine. "She's starting to miss!" yells one of the observers. The pilot silently adjusts his spark and throttle. She picks up, but the rhythm is again broken, worse than before. All faces are tense and nerves are tightening. Lost! Over the sea! Desperately the pilot struggles to keep the engine running, but with a final crackle she peters out and the machine starts to glide down.

She lands with a splash in the water. She does not sink for she is fitted with hydroplane floats. The men cling to the machine. To repair her is hopeless in a running sea. "The pigeons! The pigeons!" a man yells. Here is a bare hope. After a struggle they manage to attach the message to a pigeon's leg and release him. The little messenger fights his way through the howling gale towards the place where instinct tells him his home lies. The valiant little heart never falters. At last he feebly flutters into his cote in England. It is his last effort though. His work is done, and his strength is spent. The attendant picks him up—dead.

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A winged messenger which saved the lives of four men at the cost of its own

The rescue of the aviators after great sufferings is another story, just as true and exciting as this. Suffice it to say that they *were* rescued. The stuffed body of the martyr pigeon is preserved in a glass case in honor of his great deed; and in the hearts of those he saved he has another monument built of gratitude.

Bomb-inspector Eagan examining a deadly contrivance recently found in New York

You've Probably Escaped This Way of Being "Blown Up"

A BOMB containing enough dynamite to demolish the walls of the building in which he lived was recently found by a resident of the Italian section of New York city. At first glance the object seemed harmless enough. It was apparently a can, about ten inches in length and three inches square, used to contain olive oil. But attached to the can was a fuse at sight of which the discoverer hurried to the policeman on post near by, and soon afterward Owen Eagan, bomb expert of New York, took charge of the death-dealing instrument.

He found inside the can about a pound and a half of dynamite, placed on a base of cement to make the bomb more effective. The fuse was about two and a half feet in length, and was connected with fulminate-of-mercury caps designed to explode the dynamite. Fortunately the fuse was not burning when the bomb was discovered.

The principle of the snowshoe applied in walking on mud when digging shellfish

Shoes that Prevent the Wearer from Being "Stuck in the Mud"

ALONG certain portions of the French coast there are extensive flats of mud that the tide leaves uncovered when it recedes. While these are by no means beautiful, they yet provide the habitants with profitable employment in addition to the usual fishing operations by reason of the various mollusks that live in the mud. To obtain these the fishermen use long-handled rakes and forks, with which to dig the shell-fish out of the mud. However, the mud itself forms a serious obstacle. It is so soft that a man sinks into it and cannot move about with ease. Hence, peculiar wooden shoes are worn which act in the same manner as a snowshoe. They support the weight by distributing it over a greater area. Similar devices are in use on the east coast of England, where they are called "pattens." The picture shows how simple the shoes are in construction.

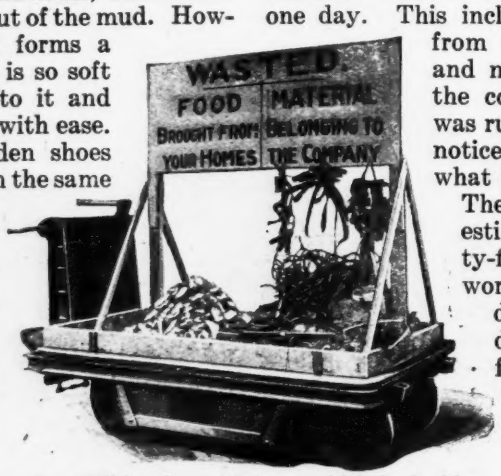
The Process of Making Parchment Paper

BY immersing paper for a short time in a fairly concentrated solution of sulphuric acid, the cellulose is converted into a gelatinous mass which fills up the pores of the paper, and, on being thoroughly washed, the paper is found to be parchmentized, or converted into a non-porous material resembling parchment (prepared skin of the sheep or she-goat). According to Alexander Findlay's "Chemistry in the Service of Man" (Longmans, Green & Co.) such parchment paper can also be prepared by immersing paper in a solution of zinc chloride; and by compressing together a number of sheets of such parchment paper, the compressed fiber, or "hard fiber," so largely used in the manufacture of trunks and as an insulating material, is obtained.

Raising a Ghost to Prevent Waste of Commodities

HOW would *you* like to have the ghosts of your misdeeds and the carcasses of your victims resuscitated for your benefit? This is what a great Pittsburg electrical company did a short time ago as a gentle reminder to its employees that we are at war.

A storage-battery truck was used for an exhibit. On it was accusingly arranged the material rescued from waste-boxes during one day. This included scraps of food from employees' lunches, and material belonging to the company. The truck was run around the shop, a notice calling attention to what it represented.



An exhibit of wastefulness which is doubly reprehensible now when economy is a duty

The company's officials estimated that from thirty-five to fifty dollars' worth of food was wasted daily, and hundreds of dollars' worth of manufacturing material. This would be a total loss to the company if it were not for the efforts of a staff of "recovery men."

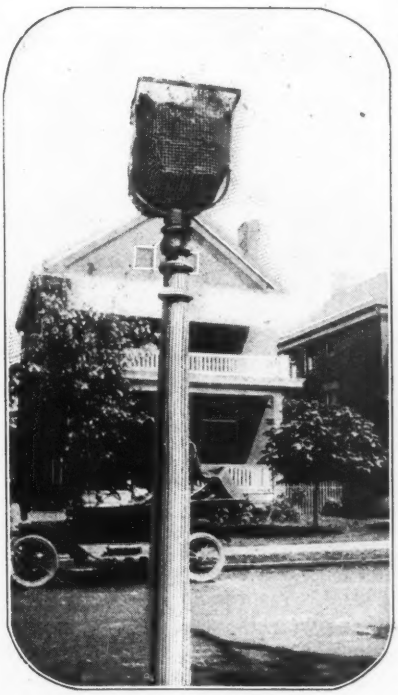
Hanging Flower-Gardens in Old Gas-Lamps

OUT on Blair Avenue, in a residential section of Cincinnati, a flower-lover had a happy inspiration. There had been a change made in the street lamps used. The older-style gas-lamps were discarded, the glass globes were removed, and only the old poles and the lamp-frames were left.

"Good enough!" thought the flower-lover.

Down in his cellar there was some old window-screening. It was the work of a moment to rip the screen itself from the frame, take the family ladder to the sidewalk, and wrap and bend the screen to the prongs of the lamp-frame.

Soil from the yard; seeds from the war-garden; water when needed—and lo, in a very short time each lamp-post had its hanging garden.



An old gas-lamp filled with flowering plants in a Cincinnati street

A Breath-Guard—But Not the Kind You Mean

A MAN'S breath is often a betrayer of secrets. He may have been out late, sitting up with a sick friend, but when he reaches home his loving wife at once opens up her battery of reproaches.

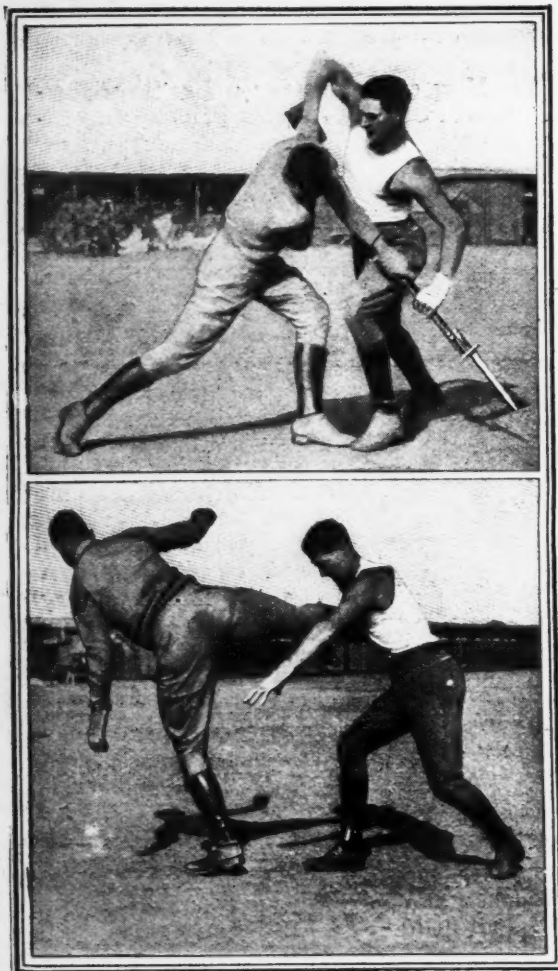
Now comes the news that two inventors in Osceola, Arkansas, have jointly invented a breath-guard of a new pattern. It is said to be efficient, but not in the manner you were thinking of. It is intended to protect dentists, barbers, and physicians, from inhaling the germ-laden breath of their patients or patrons. It consists of a small, curved shield of glass placed so as to cover the nostrils and held in position by a spring clip gripping the partition wall of the nose on the inside. Many diseases are directly communicated through the inhalation of tainted air, and a device of this kind should be a boon to professional people who are compelled, by the nature of their duties, to be in close proximity to those whom they serve. The *patrons* of some barbers may also need it.

No matter how strong your breath the barber is safe. The shield shown protects him

Old Age Is Not a Matter of Years, But of Recuperative Power

IT would seem that the phenomenon of growing old has really nothing to do with the number of years that an individual has lived, but depends principally on the extent to which he has conserved his recuperative powers. The human body wears out in two ways, i.e., either by long-continued use or by long-continued disuse. In the former case it is like bending a wire back and forth in one place until it breaks, and in the second it is the atrophy of organs or functions through disuse. The only way to stave off old age is to eliminate all forms of abuse and live as Nature intended us to live.

Cannon May Kill at Ranges of Five and Ten Miles; Machine Guns May Fire Six Hundred Shots in One



Disarm!

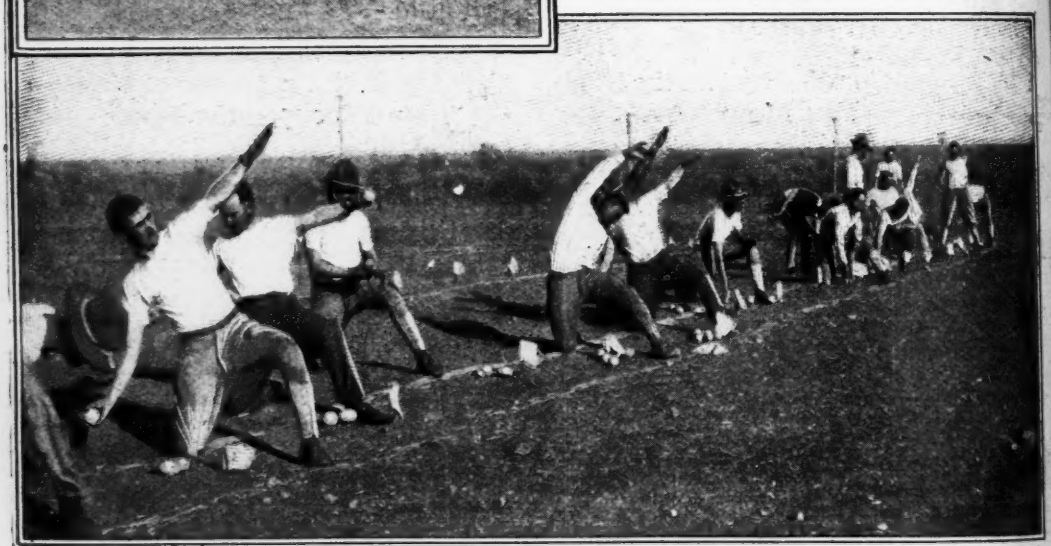
Jiu-jitsu wrestling methods are introduced in warding off a bayonet attack. While these boys are here fighting as friends, there is a background picture in their minds which adds zest and "pep" to their struggle

Wringing His Neck

Trying to disarm and disable his opponent by throwing him with a neck hold. What these lads must face "over there" lends realism to their work

The One-Step

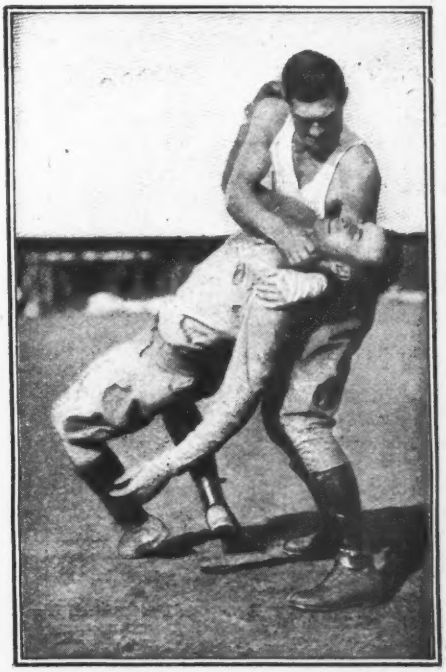
A good grip on a man's toe is by no means a hold to be "sneezed" at. These two troopers are doing strenuous work—offensive as well as defensive



A Class in Hand-Grenade Throwing

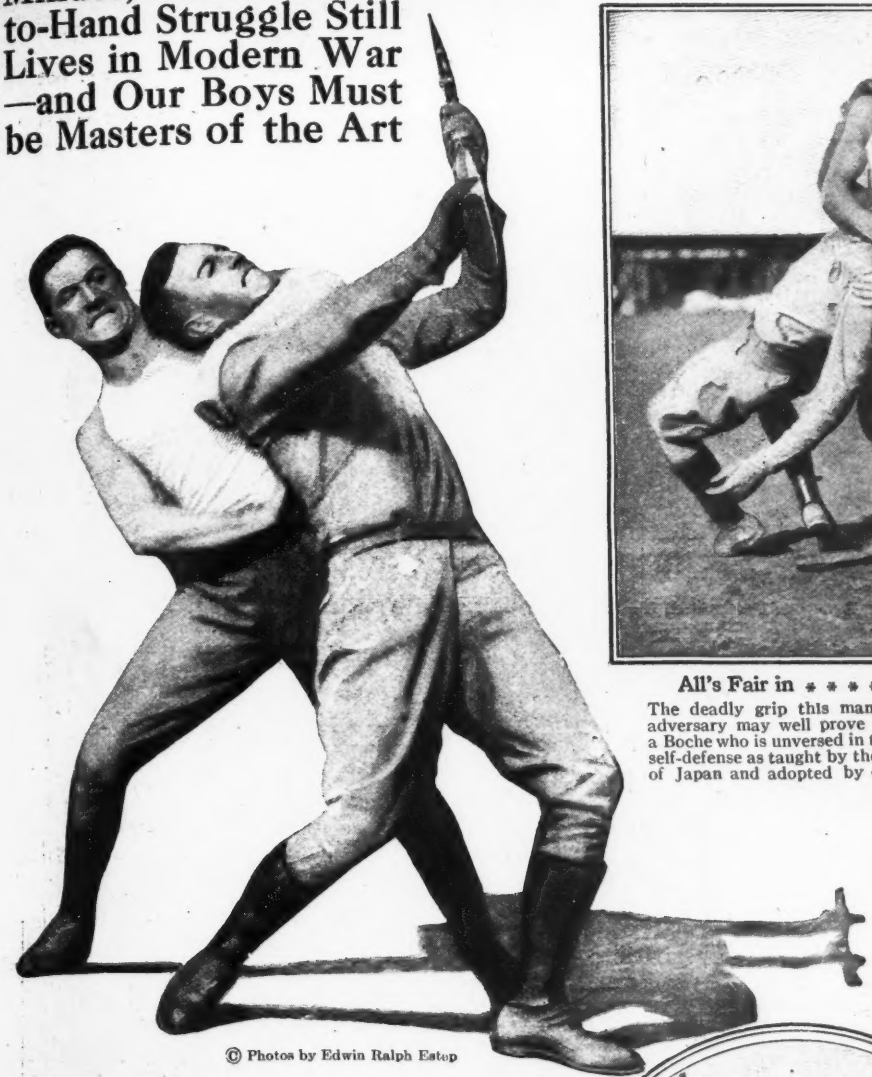
No, they are not training to become baseball pitchers! They are trying to toss cement balls into an enemy" trench indicated by chalk lines. When they get across the ocean they will use deadlier missiles calculated to put a permanent quietus on some of their adversaries. This squad is the "kindergarten" class in bomb-throwing

Minute; But the Hand-to-Hand Struggle Still Lives in Modern War —and Our Boys Must be Masters of the Art



All's Fair in * * * * and War

The deadly grip this man has upon his adversary may well prove the undoing of a Boche who is unversed in the gentle art of self-defense as taught by the modern school of Japan and adopted by our "Sammies"



© Photos by Edwin Ralph Estep

A Strenuous Game

A strangle hold calculated to break an adversary's neck and prevent him from driving home that deadly bayonet. There is earnestness in the face of the unarmed fighter. You can see that his whole soul is in his work, for success or failure may mean all the difference between life and death to him some day—and to the Boche who opposes him

A Dash to the Dressing Station

Picking up a man lying prone on the ground and running with him on your back for fifty yards is not as easy as it looks to these huskies. It is all in the day's work for the training "Sammies." One man picks up the "wounded comrade" and runs with him for that distance, when he deposits him on the ground. Another make. the return trip

Woodenware and Hardware Hats the

Since we men editors are not masters of millinery lingo, the best that we can do is to describe this thing at the left as an ultra-chic and daring creation with a wooden bowl foundation trimmed with two butter paddles rampant and two dozen mustard spoons couchant

Stunning bonnet of military effect. The foundation is a wire cheese-hood and it is trimmed with wire-screen and sink-brush

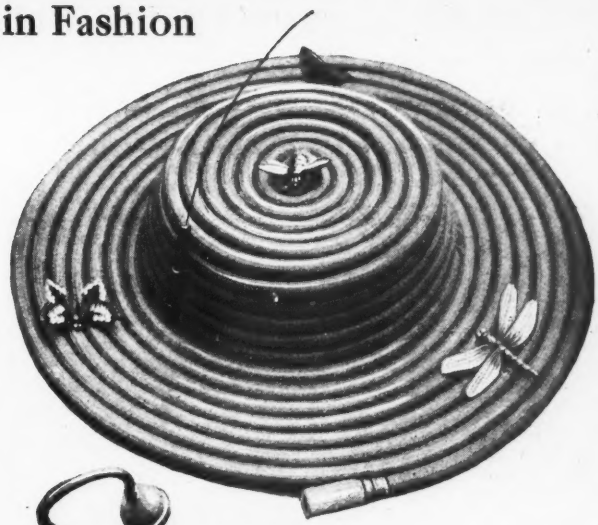
Chaste sport hat woven of electric light wires, trimmed with a bright band of lamp sockets and a cascade of tassels

Photos © Underwood and Underwood

A perfect dream (some might be inclined to call it a "scream") is this ultra smart chapeau, also built upon military lines. The cunningly shaped wash-basin body is tastefully trimmed on the side with two egg beaters crossed in the form of a big bow

Very Latest Thing in Fashion

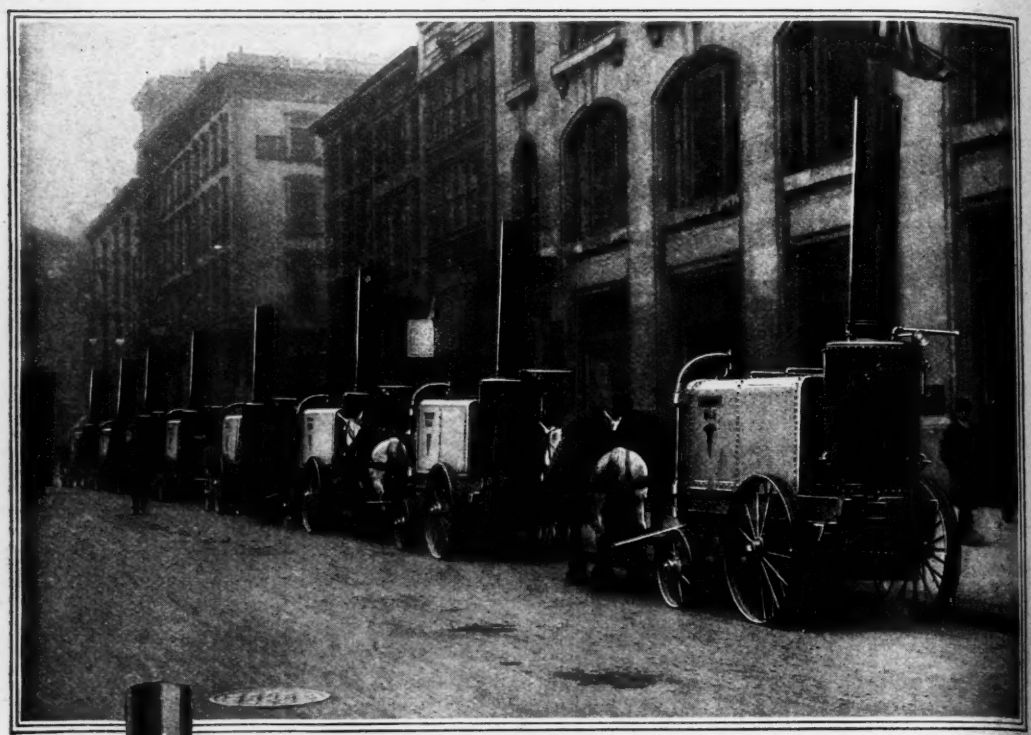
Severely plain are the lines of this coquettish sailor hat made on a foundation of gas-hose and daintily trimmed with a wire aigrette and imitation insects



Right cunning is this natty tailor-made hat with rubber-mat brim and ice-bag crown, trimmed with a band of gas-pipe and a stunning loop of the same material

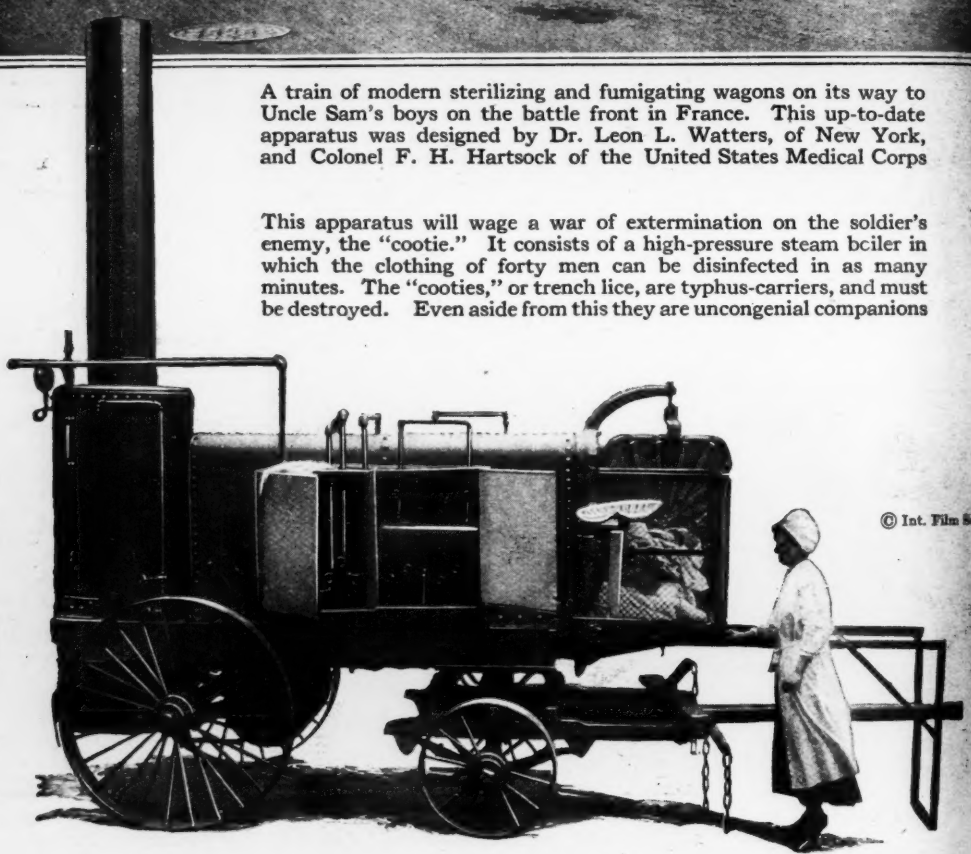
How could a feminine heart resist this ultra charming creation of artistic design? The straight brim is made from a pot-cover, the crown of coiled rope, and the foundation is a cake-pan strikingly trimmed with sandpaper triangles and a rope rosette

"Cootie" Annihilators for General Pershing's Army



A train of modern sterilizing and fumigating wagons on its way to Uncle Sam's boys on the battle front in France. This up-to-date apparatus was designed by Dr. Leon L. Watters, of New York, and Colonel F. H. Hartsock of the United States Medical Corps

This apparatus will wage a war of extermination on the soldier's enemy, the "cootie." It consists of a high-pressure steam boiler in which the clothing of forty men can be disinfected in as many minutes. The "cooties," or trench lice, are typhus-carriers, and must be destroyed. Even aside from this they are uncongenial companions



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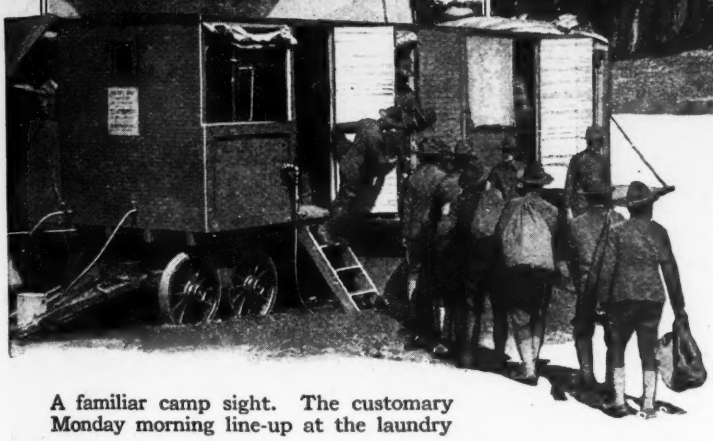
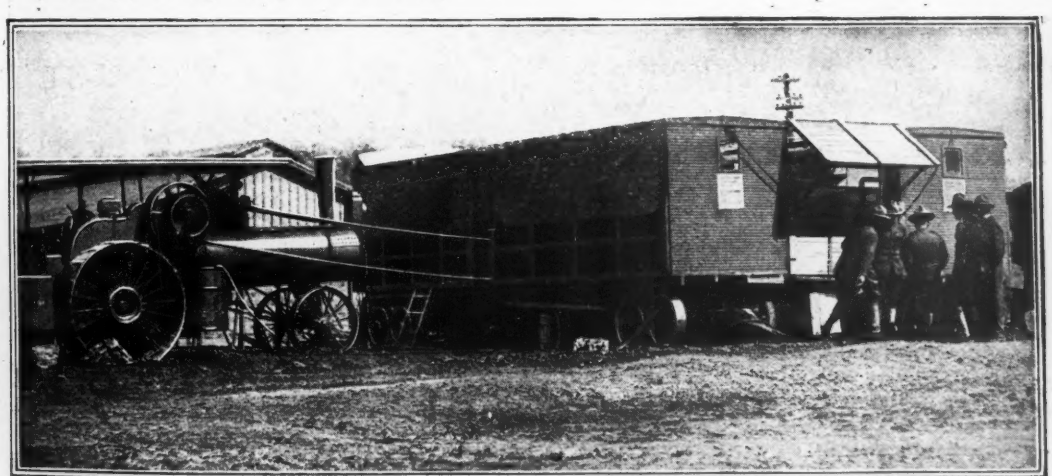
Helping the Soldier Boys to Keep Themselves Clean by Means of a 22 Horse-Power Portable Laundry

A stack of army coats that have been laundered, pressed and made ready for distribution

A busy day at the receiving and delivering counter of the laundry which can do the washing for 4,000 men a week



A familiar camp sight. The customary Monday morning line-up at the laundry



Photos © Int. Film Serv.

General view of the laundry. It consists of four wagons placed together and is operated by a 22-horse-power tractor. The Chinaman-power of the laundry has not been figured out

The Symbol of Each Patriot's Devotion,

An appropriate setting for the portrait of the soldier

A watch fob which shows the American flag in full colors on a golden shield

Patriotic emblem of classical design to be worn in the buttonhole of the lapel

Breathes there an enlisted man who would not wear such a ring as this?

An incandescent lamp in the National colors is the latest novelty in patriotic decorations for the home

Service emblem transparency for the front window which shows up well

This bracelet with the President's portrait for young ladies

A neat little device that will hold three flags in place. Use three American flags in it or make a combination of the Nation's flag and those of any two of her allies

Three Cheers for the Red, White, and Blue

Membership emblem of the Fulton County Corn Growers' Association

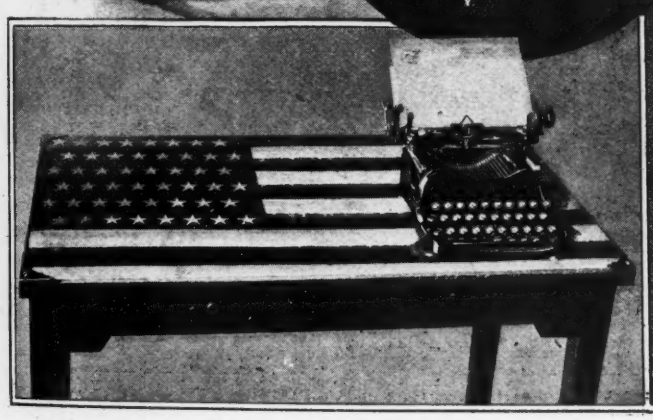
The new Liberty clip for holding the pen or pencil

This writing case makes it possible to write in any position, even squatting as this sailor lad is doing

What the soldier's writing case contains is here shown. It is compact, handy and will please him

An up-to-date dinner favor is in the form of a soldier's hat. Do you like it?

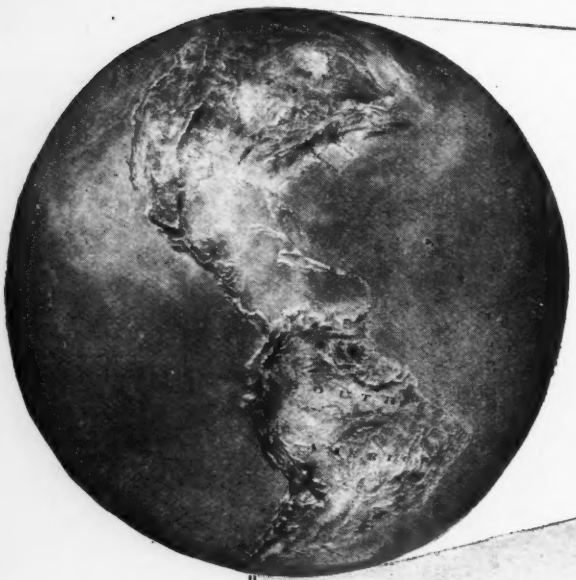
This patriotic badge may appeal to young boys. "Helmet the Kaiser" is the inscription it bears. We are not able to translate it



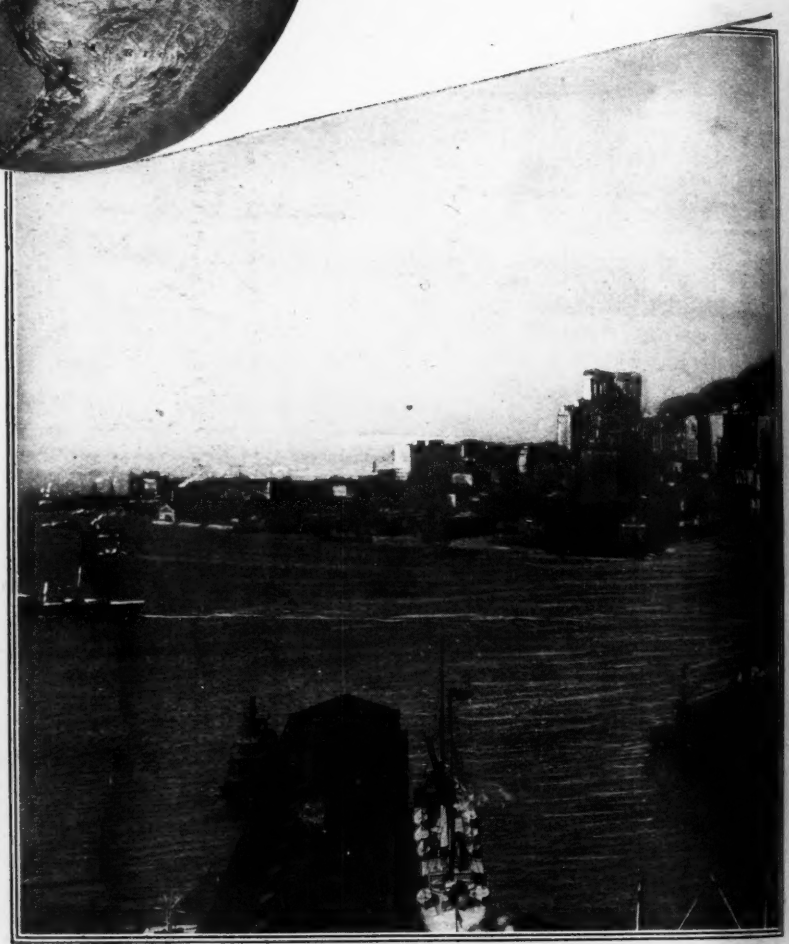
Typewriter table dressed in the National colors, so that it will not interfere with the typist's speed

Even the baby's dispatch car displays the red, white and blue

America's Five Million Pleasure Cars Represent

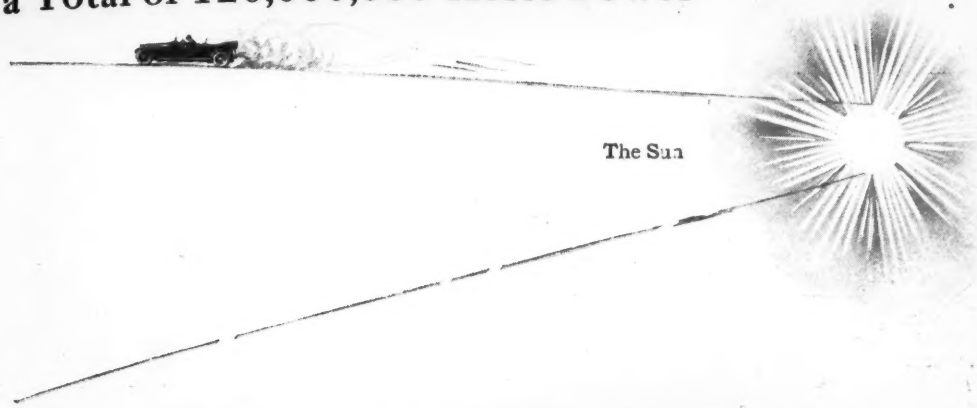


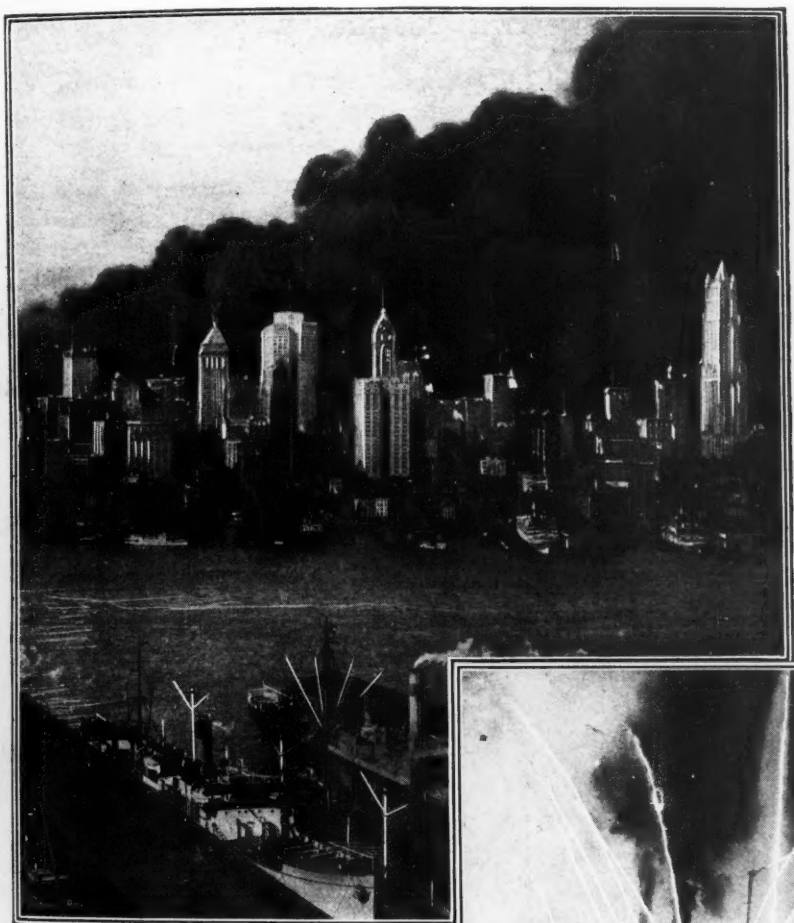
If it were possible to concentrate into one car the aggregate of 120,000,000 horse-power of the 5,000,000 pleasure automobiles in the United States, that car would be able to travel with a speed of 155,000,000 miles an hour, somewhat less than one fourth the velocity of light. Ignoring speed laws it would travel from the earth to the sun in 35 minutes

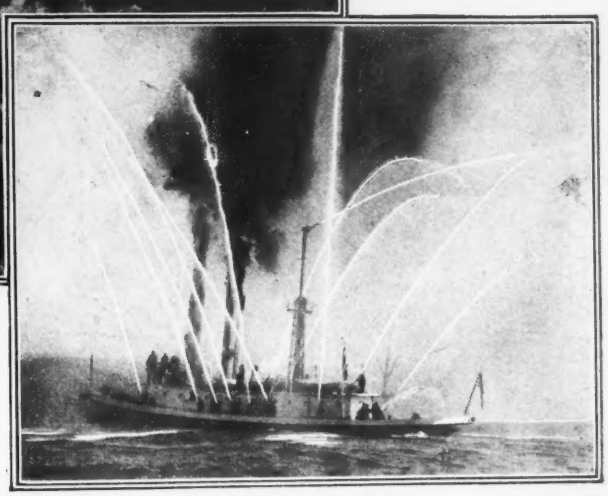


Each vehicle uses on the average 500 gallons of gasoline a year, a total of 2,500,000,000 gallons. To pump all this gasoline would take one of the modern fireboats eight months. In that time, if the city had been in flames, that same fireboat could have thrown enough water upon the buildings of Manhattan Island to drench every structure

a Total of 120,000,000 Horse-Power





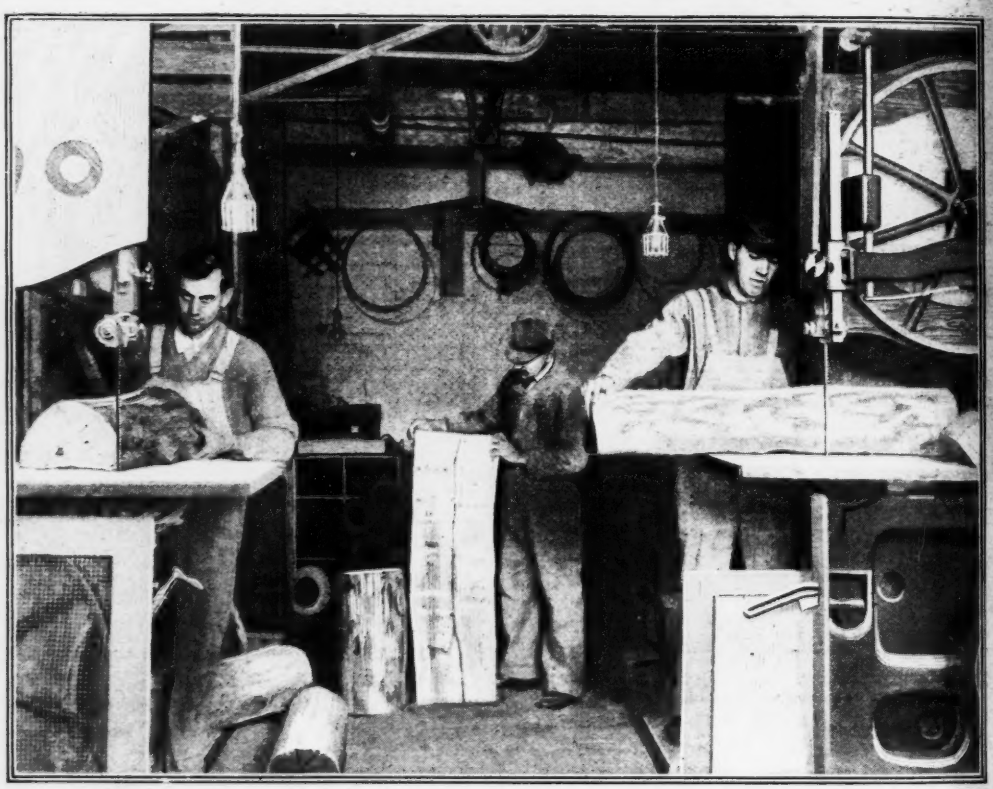


These fire boats are very powerful. At a pressure of 125 pounds their pumps can deliver 5,000 gallons of water a minute. Under favorable conditions the streams of water can be thrown to a height of one hundred and fifty feet or more

From Logs to Legs:—Converting the Limbs That

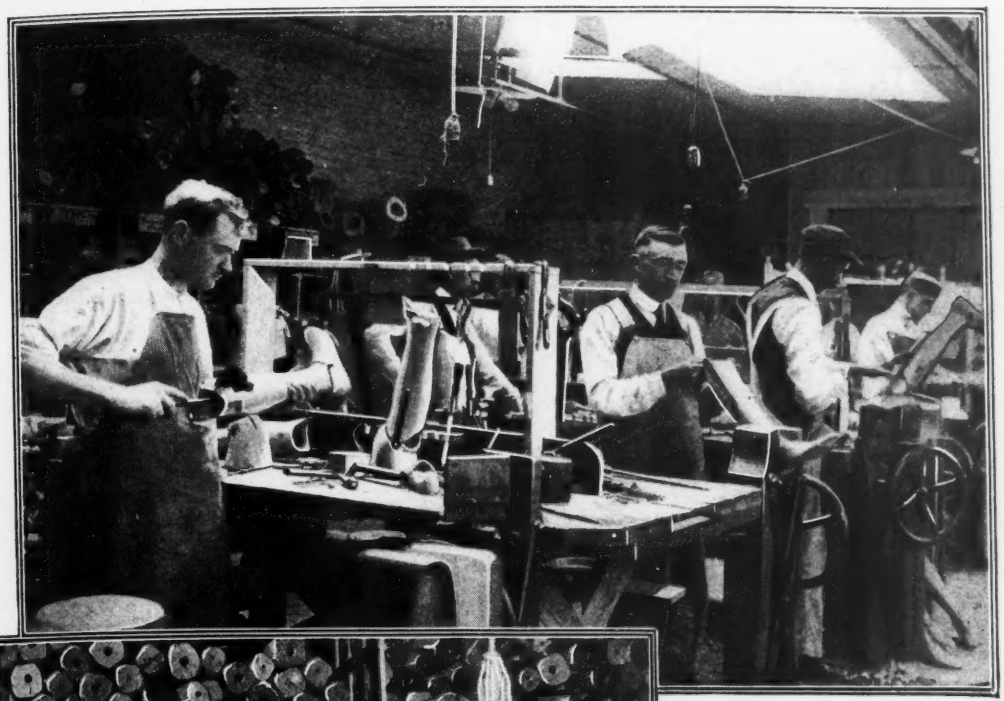
At the right is shown a pile of English willow wood, the principal raw material of the artificial-limb industry founded in Washington D. C., by a Civil War veteran who had lost a leg

Photos © Int. Film Serv.

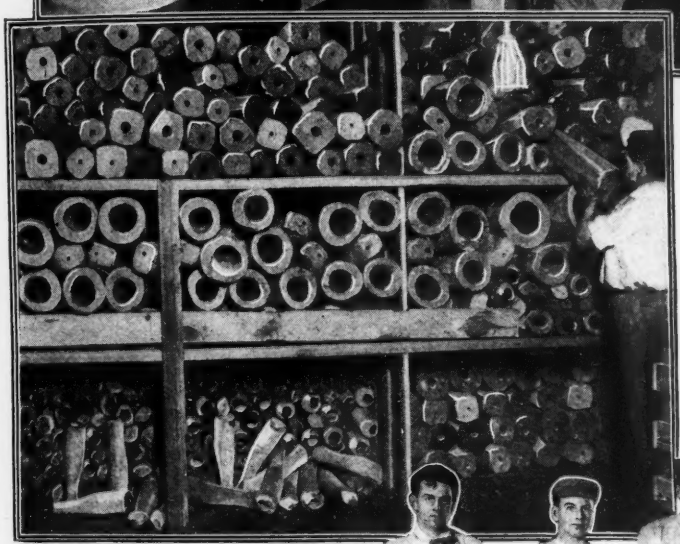


The illustration above shows the first step—the sawing of the logs into pieces of various shapes before they are put away to season. Only wood thoroughly seasoned is used for limbs

Grow on Trees Into Limbs for Crippled Soldiers



View of one of the work-rooms, where expert workmen turn out thousands of artificial limbs for the crippled soldiers

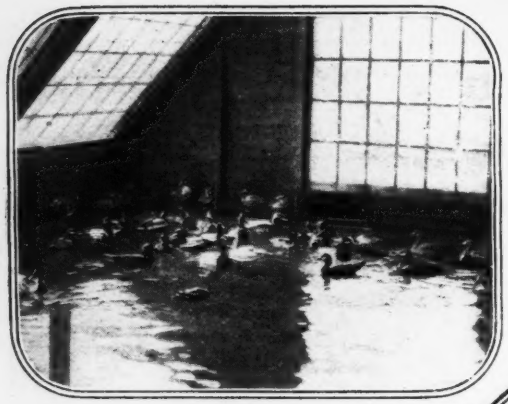


Section of the stock-room of the factory. It contains enough blocks and partly shaped parts for ten thousand artificial limbs

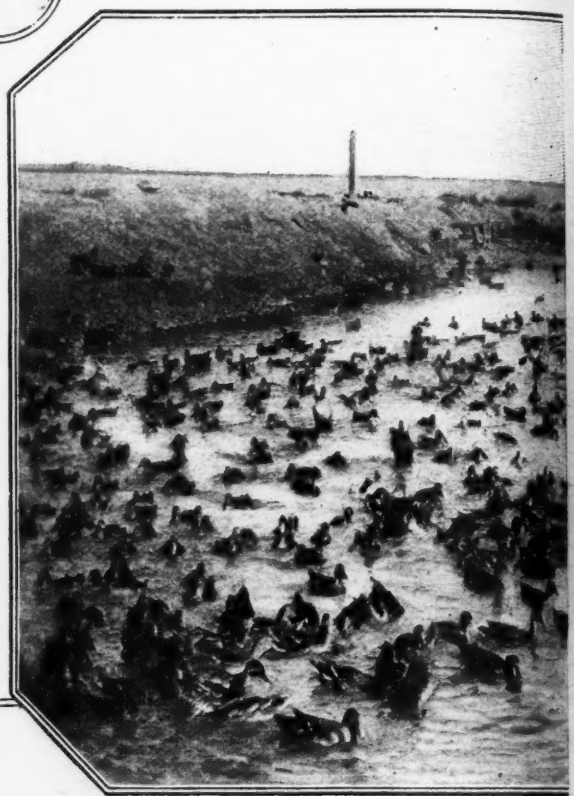
Many of the employees of the factory are cripples. Here are five who, together, have only three natural legs, and who are now engaged in helping their brothers in misfortune. The factory employs about 250 workmen

Making Game Birds Pay

The propagation of wild game requires careful attention to details. No one who does not feel a deep interest in the birds themselves is qualified to undertake it. Breeders of wild birds are advised to begin on a small scale and learn, by first-hand experience, what those well versed in game farming term the technique. One expert in rearing wild birds advocates for beginners the establishment of a game-raising section as an adjunct to other diversified farming and a gradual development of the project. A few ring-necked pheasants make an excellent nucleus for a game farm for the enthusiastic beginner.



At Amston, Connecticut, on the property of Mr. Charles M. Ams, the National Association of Audubon Societies has built a wild-duck house to solve the problem of wintering. The structure is boarded down into the water to within less than a foot of the bottom of the pond. The pond contains a floating platform on which the ducks may feed, rest and find shelter



Wild ducks and geese on the game farm of John Haywood, Gardner, Massachusetts. The common native Canada goose breeds readily in captivity. The main requisite for raising wild ducks and geese is a small pond

The pictures on these two pages come to us from Mr. Herbert K. Job of the National Association of Audubon Societies. They represent one phase of the interest in rearing wild birds. The possibilities are unlimited. Our domestic poultry was originally a wild species—extremely wild—with

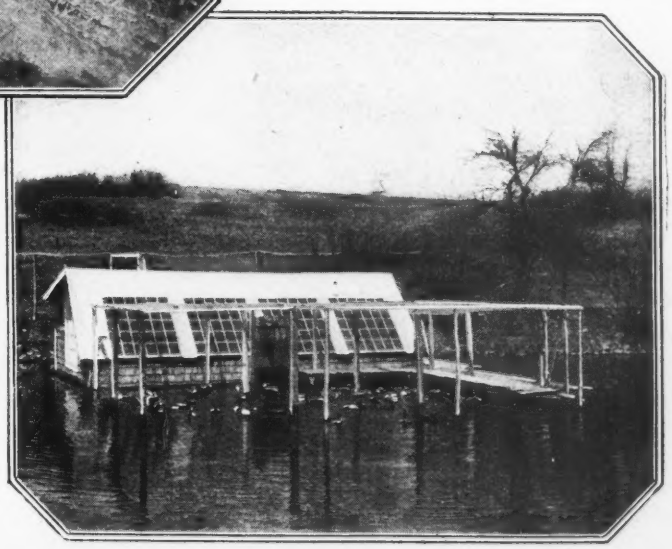
On Your Own Home Farm

They are easy to obtain and, furthermore, pheasant-raising is considered the most profitable branch of game-raising at present. The birds are light eaters, of good size, and they, as well as their eggs, bring excellent prices. Aside from the pecuniary aspects, however, there is a fascination in the raising of game birds which will amply repay the bird-lover for the time and money he may devote to this enterprise. If you are interested in raising game for profit or pleasure, write to the National Audubon Association, 1794 Broadway, New York city, for information on the subject which they are glad to furnish

While pheasant raising is the most lucrative branch of game-breeding, many prefer to rear quails, as the young birds stay with the hen and run with her for shelter to the coop during showers, whereas young pheasants often merely squat on the ground

This is an exterior view of the duck-house at Amston, Connecticut. It solves the problem of caring for the deep-water ducks whose feet, if kept out of water during winter, are apt to freeze

restricted range. Thanks to game farming it is now the most abundant and useful species on earth. What may not be expected of the wild goose, the wild duck, the quail, the pheasant and the wild turkey when they too have been domesticated? Here is a fertile field for lovers of wild life



German Supply Station Is Totally Destroyed

© Int. Film Serv.

The Railroad Station Is Now a Series of Shell Craters

1. Supply railway trains running on newly-laid tracks.
2. Piles of supplies, chiefly timbers for use in building dugouts.
3. Rolls of barbed wire.
4. Piles of iron stakes used for stringing barbed wire.
5. Steel roofing for dugouts and gun positions.
6. Site of railroad station before it was destroyed by French artillery. Note the big shell craters (about 60 feet across) caused by 420-mm. shells.

7-8-9. Remains of railway tracks near station site.

When a French Airplane Observer Gives the Range

Rails Are Dislodged, Ties Broken, Ammunition Exploded, Supplies Destroyed

10. Broken and dislodged ties of former railway tracks.
11. Other supplies piled up. Perishable goods covered with tent cloth.
12. Battery of four guns, with abris (shelter) for the gunners. Emergency trench shows in front.
13. Dugout of headquarters. The roof can be seen.
14. Ammunition park. Note the German soldiers standing around.
15. German soldiers standing in the road watching the French airplane that snapped their picture and took observations of the destruction.

© Kadel and Herbert

If the blindfolded French soldier succeeds in cutting the string, he gets the package of tobacco suspended

Cut the String, Blindfolded, and Win a Package of Tobacco

THERE are times when the soldiers in their camps or cantonments may give themselves up to rest or pleasure. After all, men are but boys grown up and must have their recreation. Realizing this, the military authorities in France provide as much entertainment as possible for the men off duty, but as a rule the men must rely for their amusement upon their own resources. Games of every kind are played. The illustration shows one of the favorite forms of a blindfolding game played by soldiers in their leisure hours. Strings are stretched from tree to tree and from these strings packages of tobacco are suspended. The player is blindfolded and provided with a pair of scissors. With one hand he seeks to cut the string from which a package of tobacco is suspended. If he succeed the tobacco is his.

Saws Without Teeth to Cut Through Metal

NOT so very long ago the discovery was made in Germany that metals could be sawed easier and quicker with rapidly revolving smooth disks of steel than with toothed circular saws. It was found that the cutting was done by the heat generated by the friction of the edge of the disk against the metal. The metal is melted at the point of contact, while the steel of the disk, being cooled by the air, does not reach the melting point. The disks need no sharpening and do not wear out so quickly as the toothed saws heretofore used for cutting metal. The faster the disk revolves, the greater the amount of heat generated, and the quicker the job.

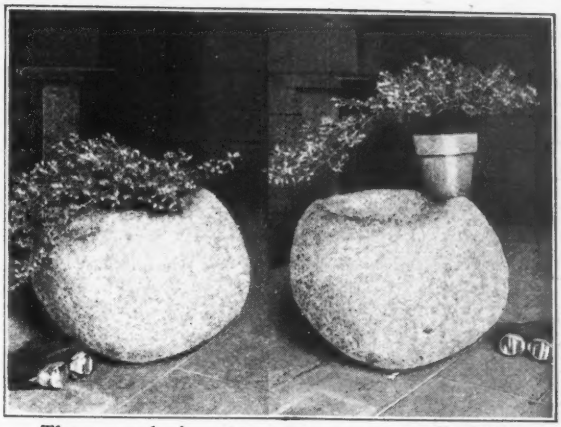
Introducing the Busy Honey Bee—Ecclesiastical Architect

FOR centuries bees have excited wonder and admiration. Their architectural skill is dwelt on over and over again. But did anyone ever hear of their building a church? It's been done. The accomplished and cultured swarm of superbees that did this belong to Mr. George F. Bowersox, of Portland, Indiana. Unfortunately we cannot give the bees credit for originating the idea. Mr. Bowersox did that. He made a framework of light laths and covered it in so that the bees would consent to use it as a hive. They industriously filled in all the spare space with comb, which is precisely what their owner wanted. The result is that they have allowed themselves to be beguiled into constructing a church, which, as can be seen from our illustration, is a really attractive piece of architecture.

Bees built this little church after their owner's plan

Air Raiders Don't Like These Lights

DURING their recent raids on Paris the German aviators were greatly disconcerted by rockets which the French sent up and which discharged, before dropping, parachutes with brightly burning fuses. These parachutes dropped slowly and their fuses cast a brilliant glare upon the hostile airplanes, making them a good target for the anti-aircraft guns. It is a safe guess that the free fireworks were not enjoyed by the Germans.



The ground pine seems to grow naturally right out of the boulder and the effect is very attractive

Artificial Birds Give a Realistic Appearance to the Flower Bed

BIRDS are sociable creatures. If one finds a pleasant spot and seems to stay around it, his presence will do more than anything else to attract others. For this reason the use of artificial birds in garden plots and as props on which to train growing vines has found favor.

The birds are pivoted on stakes of varying heights so that they may be used in beds of dwarf plants or tall ones. The effect is very pleasing to the eye.

Artificial birds mounted on sticks are ornamental in the garden and attract other birds to the spot

How a Floral Urn Was Made From a Boulder

A LARGE granite boulder hollowed out as a receptable for a potted plant is the ornament which adorns the porch at the home of Paul Brochier, on West Adams Street, Los Angeles.

The rock is practically round, except that it is slightly flattened on the base to give it a firm setting. With an ordinary rock-drill the inside of the stone was hollowed out so that a large flower pot would fit in exactly. A small drainage hole was drilled through to the bottom and a ground pine was planted in the flower pot.

Old Tin Cans Figure in Milady's Costume

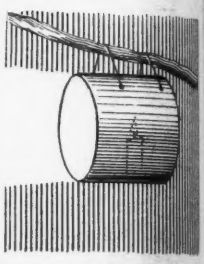
FEW women who are proud of the fact that they wear hosiery, underwear and dresses made of silk, realize that old tin cans contribute from twenty to three hundred per cent. in weight to the glossy silks worn by them. The price of silk has increased enormously and to enable them to sell heavy silks at a price that will yield a reasonable profit and yet be within the means of the average purchasers, the manufacturers resort to the practice of weighting the silk with tin tetrachloride, derived from old tin cans. Five thousand tons of tin were used for that purpose in 1917. Don't throw away the empty tomato cans!

Some Home Camp Comforts For Those

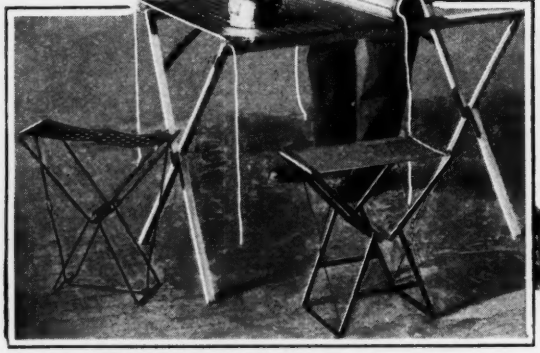
This collapsible canvas house tent is roomy and comfortable, and can be rolled into a small bundle for shipment

A duffle bag with side opening and a waterproof clothing roll made of duck

Candle lanterns made of cans, one for a tree limb and the other for a tent



Boiler improvised of a small and a large pail, the small pail resting on stones

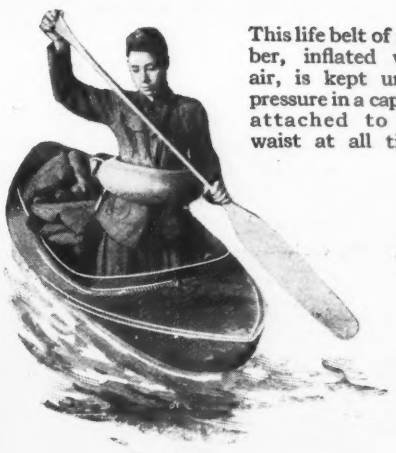


Folding camp chairs, a slat curtain-roll table top and a gas lantern for the camp. A compact and convenient set of furniture

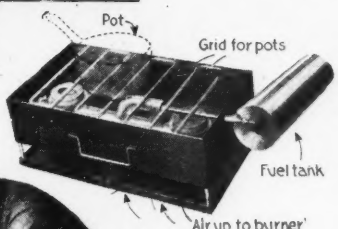
This three-piece camp shovel fits in a one-foot tool box

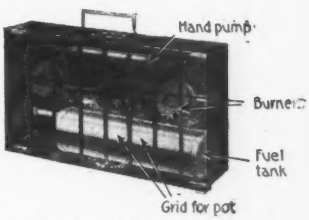
Who Love Life in the Great Outdoors

Cobble-stone fireplace for burning the campers' garbage and refuse



This life belt of rubber, inflated with air, is kept under pressure in a capsule attached to the waist at all times

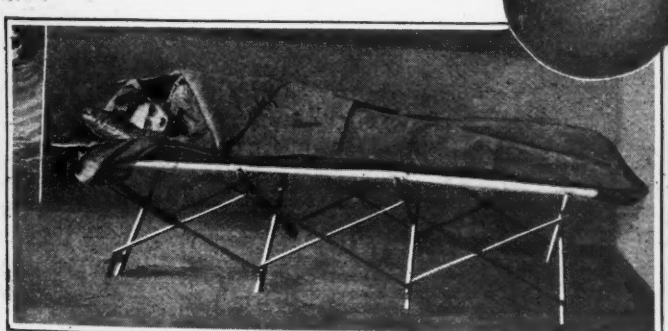




A compact automobile folding camp-stove which uses either gasoline or kerosene for fuel

A folding oil-stove with two burners. It occupies little space and is very handy

A home-made carrier for the canteen made of a strap and a snap



This waterproof duck kapok sleeping-pocket has an outside covering to keep the pocket dry when it rains. It is a very useful piece of camp furniture

A canteen which is hung to an overhead branch and tilted by pulley and cord for filling a cup

The Story of a Wireless Hero

How a wireless operator, with great ingenuity and resourcefulness, repaired his apparatus during a terrific gale

By J. Andrew White

I LIKE to think of Wireless Operator A. S. McKenzie as a hero, although he cannot be placed among those who have clung to a swaying table and sent out frantic appeals for aid as a submarine's shells screamed by the radio cabin. McKenzie's battle was against the greater forces of Nature. And not alone that he won, but because he stood a test of overcoming apparently hopeless difficulties by ingenuity and resourcefulness, his experience is worth the telling.

It properly begins at a point 700 miles from shore in a wintry sea. His ship, the *Pennsylvania*, was not large, nor new. She shivered from stem to stern with each plunge into the seething green wastes as the gale increased in fury; with terrifying regularity her after-deck was buried under heavy seas that swirled about the wheel-house and strained to tear it loose. Back in the saloon, off duty, the operator wondered; there had been storms, but never anything like this.

A giant wave bore down on the straining vessel. With a crash and an ominous long-drawn rip, the cover of No. 1 hatch went over the side, the funnel wrenched loose from its stays and the wreckage from a smashed-in bridge, pilot house and wireless cabin swept back with a clutter of doors that had once protected forward staterooms. Below, a muffled rumble conveyed the information that the cargo of liquid asphaltum had broken loose, threatening annihilation of propelling engines upon which safety depended.

The Storm's Work of Havoc Begins

Then, in the tumult, a pungent smell of acid arose and large streams of oil entered the saloon. All hands were puzzled; but the operator knew. The glass plate condenser of his set was mounted on the deck, and the planking was anything but secure. A crippled set to oppose the greed of the furies! A stanch spirit sank before realization of the truth.

Slipping and sliding on the oil-soaked floor, buffeted about by the roll of the ship, he fought his way out of the saloon. On hands and knees he struggled to the wireless cabin.

The place was knee-deep in water, the set a wreck. On the floor the transformer coil, two pairs of phones, accumulators, the condenser and all the cells were adrift in a slush of broken glass. A glance assured him that the service switch was up, the starter "off." Salt water, however, had usurped the function of human hands and had made a connection which kept the motor running slowly.

It must be stopped. Scrambling about, gaining a precarious hold and losing it with each wild pitch of the ship threatening to drop him amid the swirl of broken glass and smashing equipment, he worked to a favorable position. A few tugs and off came the wiring.

The Gale Redoubled in Fury

The vessel rolled her top deck under water and pitched like a frightened steed. He fled the place, in search of the captain.

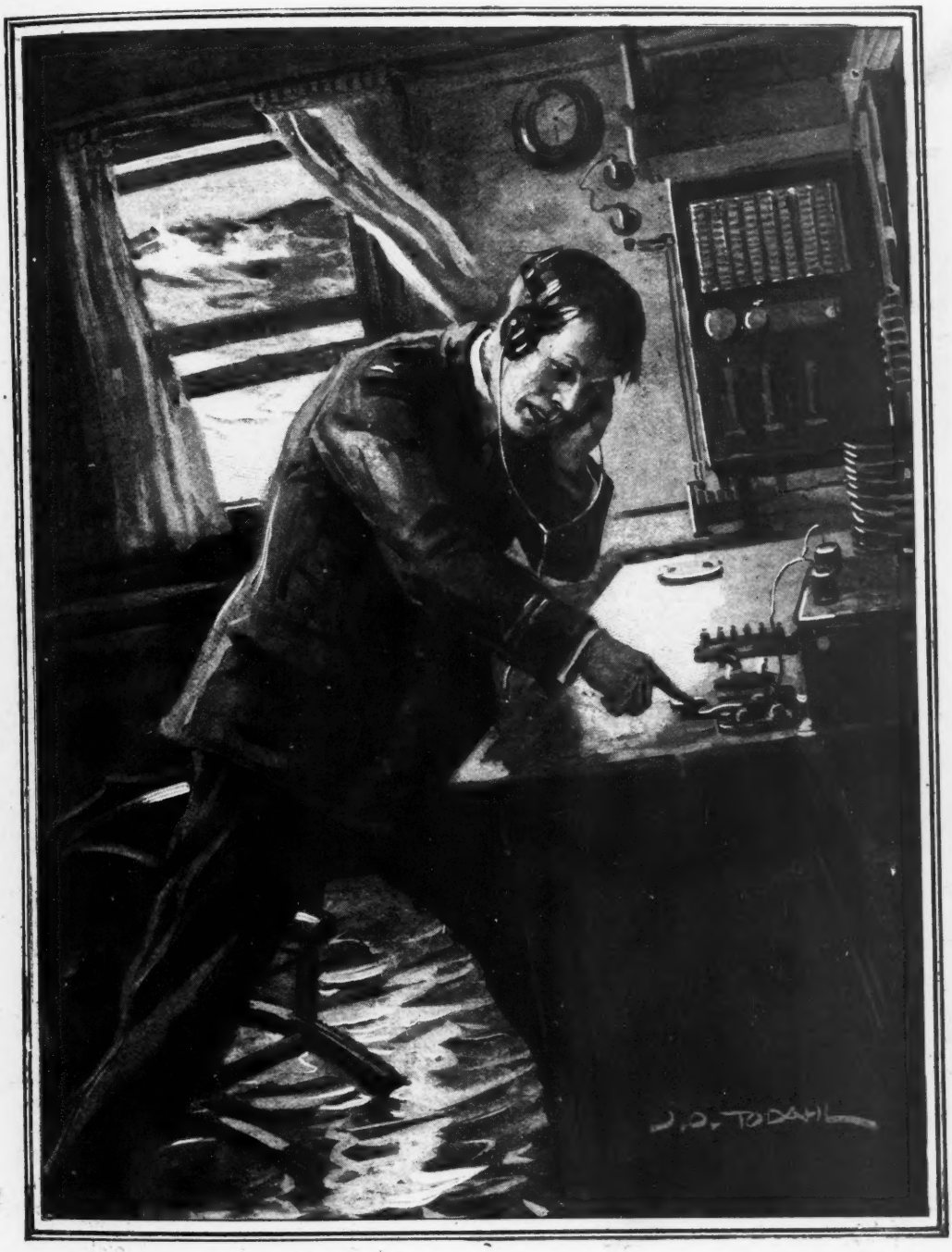
That officer was found wedged in between the stove-in bridge and the pilot-house; he had squeezed into this position to keep from being blown overboard. McKenzie reported conditions.

"Leave everything and go below!" bellowed the captain. "We can do nothing now but try to save the ship."

And below he stayed through a night of terror. There was no sleep for anyone.

With the first flush of dawn the wind died down. The day broke clear, but mountainous seas still tossed the vessel about like a cork. No immediate need for an SOS appeared, but there were important orders to be received from the owners, the captain remarked as he disconsolately viewed the wreckage in the wireless room. Every effort must be made to patch things up enough to get a message through.

"I Listened and Caught the U. S. S. Proteus"



Standing knee-deep in water—transformer coils, phones, accumulators, and cells adrift in a slush of broken glass—salt water having established a connection that kept the motor running slowly, and which must be stopped, a nearly exhausted operator, after hours of back-breaking efforts and dogged persistence, won the day—he got his message across

At nine in the morning the operator began to work, assisted by the ship's carpenter. Time passed, but practically no progress had been made on the slippery floor; then a thoughtful mate sent up a bucket filled with sand. An hour had elapsed before the transformer was back in its case and made fast. The auxiliary and accumulators were removed entirely and the condenser set upright. Spare plates which had been kept on the floor had somehow remained whole, but the acid had attacked the tinfoil and it was peeling off most of them. The container was cracked.

Asbestos Paste to the Rescue

An appeal to the engineers brought some asbestos paste to the cabin, and a so-called repair was effected. The result of four hours' intensive work was a condenser haphazard in appearance but boasting twenty-four plates.

With an intermission here consisting of space for a long-drawn breath, McKenzie turned to the task of drying out the rest of the equipment. The rheostats had to be taken down, dried and oiled with insulative oil. The starter and the transformer required the same treatment. Two solid hours were spent on the motor; first the brushes came off and the inside was oiled as well as possible; there was no time to take out the armature.

Resourcefulness Wins an Inning

It was eight o'clock then. Eleven hours of exhausting work lay behind the operator, but the race against time did not allow for a stop for dinner. He tried out the set. The first thing to go was the generator rheostat. Patiently he repaired it. It blew again. With twenty feet of iron wire wound on a pencil he created a resistance. This, after a series of patient experiments, performed its function, although the motor ran unsteadily and sparked furiously. Another precious hour had been lost.

Once again the set was started, the key depressed and a radio land station call flew off across the sea. "A great moment," McKenzie describes it. "I waited. No answer. When I tried again the starter burned out in two places.

"Once more the asbestos paste proved invaluable; but the release magnet now refused to hold. With wire I hooked it up. The motor started then; but this time the field rheostat went on strike."

More Repairs Under Difficulties

Painstaking repairs were made, only to learn that although the apparatus operated, the generator rings were arcing across the dividing rings while the brush holders were leaking into the frame.

"These defects were remedied," says the operator, telling of his experience, "and I tried again. It was now midnight. I called CQ for a long time but received no answer. . . . I had forgotten that the phones had been in acid and water all the day before.

"Although I dried out the headgear in the steam oven it was as wet as ever again in ten minutes. I tried cleaning the phones, while warm, with gasoline. Still I could hear nothing.

"The aerial was intact. I tried the tuner with the battery and found it dead. At two in the morning I succeeded in drying it out.

At Last a Hopeful Sign

"I listened and caught the U.S.S. *Proteus*. My spirits rose. I called him —and away went the condenser, shot to pieces!

"Two hours later it was rigged up again, but the motor brushes were shorting through the frame.

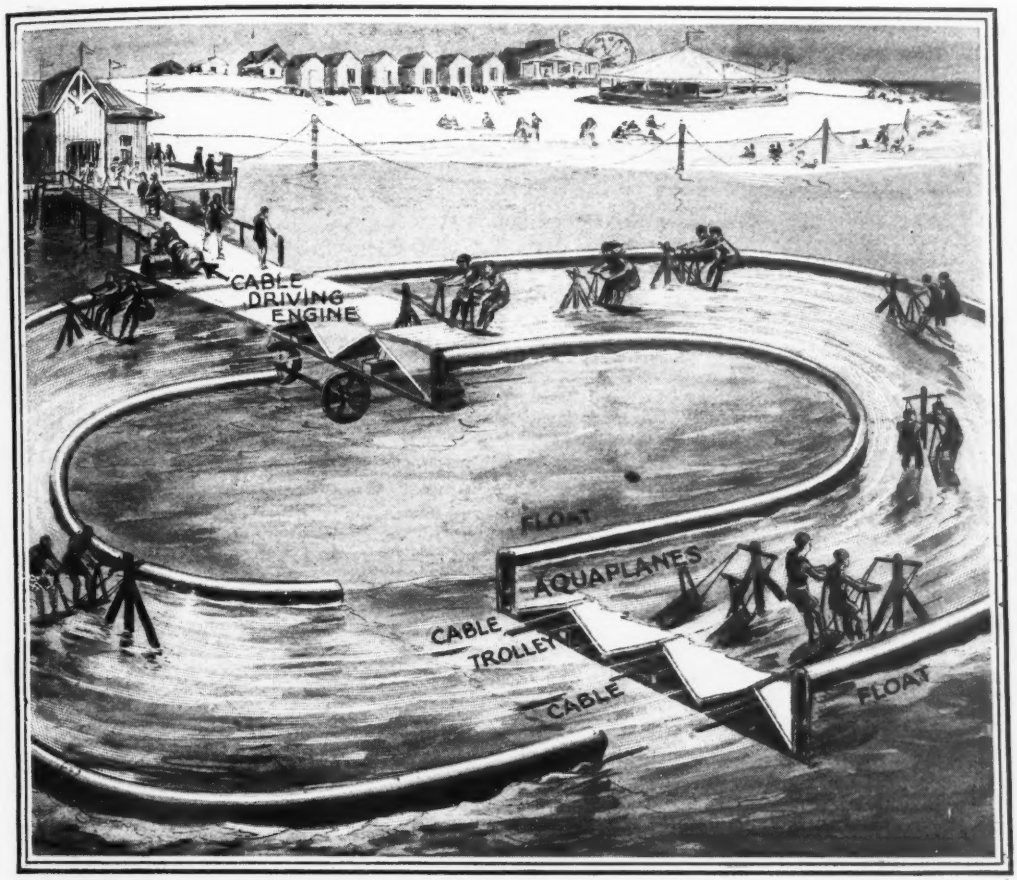
"I quit, and turned in for a nap."

At six in the morning, after a scant hour and a half's sleep, McKenzie turned to the job again. The sea still lashed viciously at the vessel's side. Practically all his work had gone for nothing. Every seam in the wireless cabin was open, the roof badly sprung and his set as wet as ever. But at noon, after six hours of back-breaking effort, he considered everything in readiness and again tried to start up. Nothing happened. All the current went to ground through the soaked insulation.

With dogged persistence he turned once more to the task. Hours slipped by, precious ones. It was eight o'clock in the evening when a nearly exhausted operator concluded his long labor with motor and wiring. But it was done; a loyal sense of duty was rewarded—this time he got his message across!

Aquaplane Racing Full of Genuine Thrills

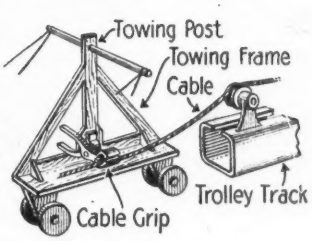
Novel racecourse provides hilarious fun with many thrills but no danger



Each channel is supported by tubular floats. The tracks, two or more in number, are elliptical. The shallow water eliminates danger but is wet enough for thrilling spills

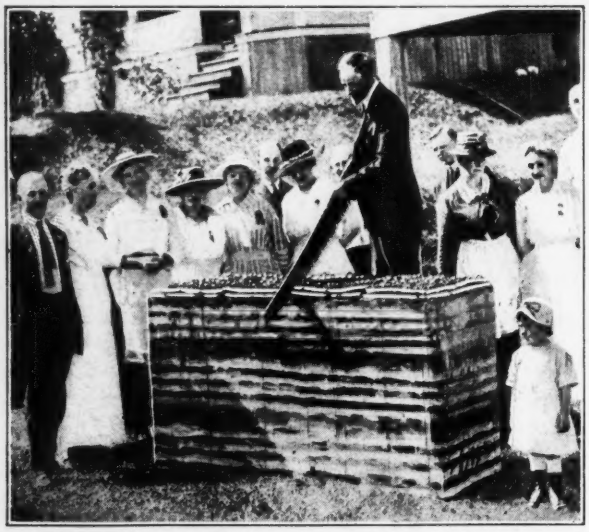
DID you ever see an aquaplane race? If you like fun, do not fail to visit the nearest aquaplane racetrack. Of course, you have seen aquaplanes in tow of fast launches, crazily lunging in the turbulent wake of the propeller, while some daring bather made frantic efforts to maintain his balance.

The aquaplane racetrack shown in our illustration is the invention of Hubert A. Myers, of Toledo, Ohio. It may be divided into two, three, or more parallel channels which form the tracks for the aquaplanes. The moving power is a cable kept in motion by a gasoline or other kind of engine. The aquaplanes are attached to upright posts of a framework, the submerged part of which runs on small trolley wheels, within a grooved trolley track, gripping the cable by means of a "gripper."



Showing how the "gripper" engages the running cable

The race is full of thrills and spills, duckings and jeers, laughter and cheers.



The problem of dividing this strawberry shortcake, too big for a knife, was solved by sawing it

A Giant Strawberry Shortcake. It Had to be Cut with a Cross-Cut Saw

EVERY year the little town of Burton, situated on Vashon Island, a few miles from the city of Tacoma, holds a good old-fashioned strawberry festival to which the public is cordially invited. The Island Commercial Club, a "live-wire" in the community, conducts the festivities. Heretofore plain strawberries, sugar and cream have been the order of the day, but the committee that had charge of the affair this year took it into their heads to do something different and original.

Accordingly they waited upon two members of the Burton Woman's Club, far famed for their culinary accomplishments, and told them to put on their thinking caps. The ladies rose to the occasion and the result was the making of a strawberry shortcake of exquisite taste and generous proportions.

No knife equal to the situation could be found, but H. G. Parkes, president of the Commercial Club, suggested the use of a cross-cut saw. Everybody echoed "Why not?"

No Very Great Danger in Making Explosives

IN a paper read before a medical association in the East, Dr. W. G. Hudson, medical director of E. I. duPont de Nemours & Co., manufacturers of explosives, recently made some interesting statements concerning the risks connected with the manufacture of powerful explosives. He asserted that the dangers of that industry were greatly exaggerated. As a matter of fact, railroading shows much higher injury and death rates than the manufacture of explosives. Of the accidents which occur in explosive factories only a small percentage are actually caused by explosives. Four-fifths of the accidents are due to carelessness or negligence of employees who disregard the precautions necessary wherever men are working with tools and machinery. By increasing the share of work done by machinery and reducing the number of workers in proportion to the increased use of mechanical appliances, the manufacturers of explosives are striving to diminish the hazards connected with their business.

Use This Detachable Handle to Protect Your Grip

IN order to make it at least very awkward for a thief to steal a bag, Mr. A. C. Aagebery, of Indiana, has invented a detachable handle. This can be fitted to both new and old bags and valises. It is merely a pair of sockets into which the removable handle-piece fits and from which it is removable by pressing a button.

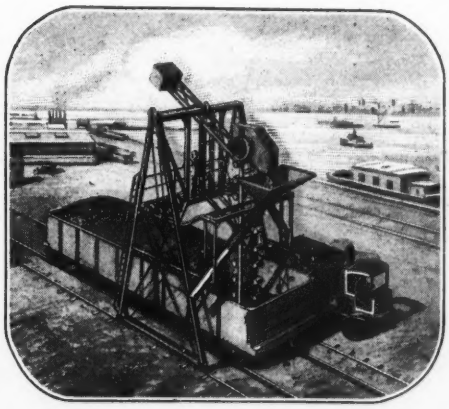
The handles being non-interchangeable, theft by fitting another handle is not possible. The thief would have to carry the bag under his arm.

Remove the handle of your grip and it will be safe from thieves

Unloading Freight Cars by Machinery

No worry then about shortage of labor

SOME of the congestion of railroad traffic since the outbreak of the war has been partly due to the detention of loaded cars in railroad yards or on sidings. In many cases companies pleaded that the scarcity of laborers made it impossible for them to unload their cars promptly. Hence, mechanical unloading of freight and coal cars has become of vital importance.



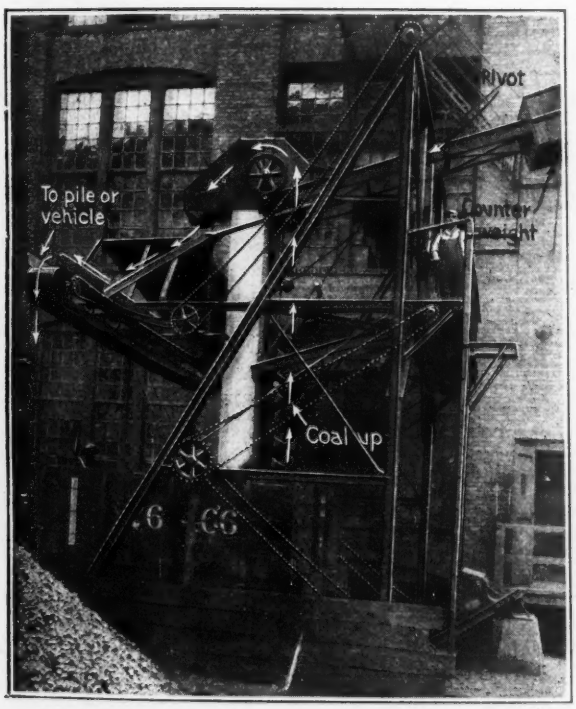
Accelerating the unloading of railway cars by the use of endless-chain buckets

Recently a Chicago inventor put on the market a mechanical unloading device, which, he claims, will not only mean a large saving of labor but also reduce the cost of unloading to one-third of what must now be paid to shovelers. The device consists of an endless-chain bucket elevator carried by projecting arms which are counterbalanced by a concrete block at the opposite end and mounted on a pivoted frame supported on a traveling bridge or crane which straddles the car and can be moved from car to car as the work proceeds.

One man is sufficient to operate this machine, which, according to the material, will unload from thirty to forty tons an hour. At that rate one operator with this machine can unload five cars in one day. To do the same amount of work by the old method would require about ten or twelve men.

The bucket-chain elevates the material to a horizontal belt which deposits the material removed from the car wherever it is wanted. Both conveyors are operated by small electric motors controlled from the operator's cab.

The entrance of the United States into the war has acted as a stimulus to inventive genius, and since the war necessarily removes from ordinary channels of labor a large percentage of men, any device that holds out promise of usefulness in substituting mechanical labor for that of man is worthy of more than passing consideration. If this inventor's claims are substantiated, one of the most serious causes of delay in freight-handling will be eliminated.



The traveling belt (at left) receives its burden from buckets unceasingly and deposits it where wanted

The combination croquet-pool game. Except for the pockets on the corners and sides no special apparatus is used when the game is played outdoors. For indoor play lighter balls are desirable

Combining Two Favorite Sports—Croquet and Pool

CROQUET enthusiasts and devotees of the pool table may enjoy the new game, shown in the accompanying illustration. It may be played either outdoors or indoors.

Pockets are fastened in place on the ground exactly as on a pool table, one at each corner and on each of the longer sides. By numbering the balls combinations such as lend fascination and excitement to pool may be obtained. Except for the pockets no special apparatus is necessary. The regulation croquet balls and mallets answer the purpose; but for indoor use lighter balls may be found more desirable and less noisy.

Water-filled Roller Combines Scraper and Handle-Lock

A MANUFACTURER of Berea, Ohio, has recently placed on the market a combination handle-lock and roller-scraper for use with lawn rollers weighted with water. This device holds the handle upright when it is not used, thus making it unnecessary to counterweight the handle. The scraper may be lowered for cleaning the roller surface. The weight may be regulated by the volume of water.

When roller is not in use the lock holds up handle

Over Fifty Different Woods Are Sold as Mahogany

THE name "mahogany" is applied commercially to more than fifty different woods. Perhaps half the lumber now sold under that name is not true mahogany, for the demand greatly exceeds the supply.

The tree is only native to the limited area between southern Florida and northern South America. Nowhere else does it really flourish. But the public will have mahogany. Women want it for furniture, business men prefer it for office fixtures, and teak and mahogany are rivals in the affections of ship-builders. Therefore substitutes flourish.

It is not surprising that the real wood is so expensive when it is learned that it takes from one hundred to one hundred and fifty years for a mahogany tree to reach merchantable size.

Most of the substitutes bear little more than a general resemblance to the genuine wood, but skillful finishing makes them very much alike. Experts can usually distinguish between them by the aid of an ordinary pocket lens. The efforts of the superficial, however, to judge the wood by its appearance, weight, grain, and color often lead them astray.

Making Money Out of Rabbits

How a young woman taught herself fur-raising and tanning and engaged in a business that anyone can learn

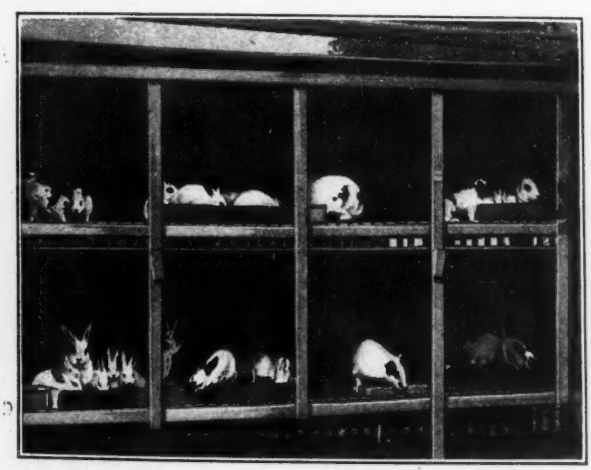
A YOUNG woman in Los Angeles, Mrs. Carl Sherman, has taught herself fur-raising and tanning and maintains a "rabbitry" of three or four hundred choice specimens. She is the founder and instructor of the "Southern California Coney Fur Club," and has a large established trade both in skins and garments of fur.

Instructions in rabbit-raising and tanning were obtained from the Government. To learn garment-making she sent to Chicago for the cheapest set of furs of fashionable cut that could be had. These she carefully ripped up, studying the seaming and finish, and afterwards using the pieces for patterns. Now she makes fur sets—muff and cape—that sell for forty or more dollars.

After being tanned the skins are softened by scraping and rubbing

In her own back-yard, on a fifty-foot lot, are pens of up-to-date construction full of aristocrats in the coney-world—Himalayas, English Snow Shoes, Imperial Blues, Flemish Blacks, French Silver, little Japanese and other varieties. And in her cottage are chests full of preserved skins that sell for eight dollars each unmade, while her transactions in made skins amount to several hundred dollars a month.

Yet a child could learn the trade, she declares. The formula is simply five gallons of water, four pounds of common salt, and two ounces of sulphuric acid, made into a solution, in which the skins are soaked from six to twenty days according to their weight; they are then dried in the shade, pulled and stretched by hand, and rubbed over the edge of a hardwood board until pliable. Finally they are immersed in gasoline, rubbed over while wet with corn-starch or fuller's earth, dried in the sun, and brushed.



Only aristocrats of the rabbit world occupy apartments in Mrs. Carl Sherman's strictly modern hutch

Having mastered the business in its details, Mrs. Sherman last October formed a club of her neighbors, which in December had thirty-two members, all raising their own rabbits, tanning their own skins and making fashionable fur pieces for the trade.

The club prepares an exhibit of fur garments for the annual show of the California Rabbit Association. This exhibit includes a wide variety of fur pieces, such as hats, muffs, capes, scarfs, slippers and bags—all of fashionable cut and beautiful shades and markings. The club never lacks a market for its wares; as a matter of fact, the members find the demand exceeding the supply.

Six motor-cycles on each side in this tug-of-war pulled until they were exhausted

Two Teams of Six Motor-Cycles Have a Tug-of-War

"ARE you ready? Go!" Then follows a series of explosions. "Gr-r-r! Bang! Bang! Bang! Whoosh! Pop! Pop! Pop!"

This, coupled with clouds of sand flying, and shouts and laughs from the spectators, gives a slight idea of what recently took place on a California beach.

Following a friendly argument concerning the pulling power of different makes of machines by members of the Los Angeles Motor Cycle Club, a tug-of-war for motor-cycles was arranged. The competing machines were arranged in teams of six, and hitched to a one-hundred-and-fifty-foot manila cable. The engines were started up, and, at a given signal, all the clutches were let in together. For ten minutes the game little machines pulled each other back and forth along the beach. At the end of that time they had all dug themselves in until they could run no longer. The winning team won by just eight inches!

Bathtubs for the Eyes. They Have Running Water, Too

FRIEDRICH MAIER, of Elizabeth, N. J., suffering from some eye trouble, consulted an eye specialist who recommended, as part of the treatment, frequent bathing of the eyes in cold water. Mr. Maier found these baths beneficial, but did not like the manner of taking them. After having given the matter considerable thought, he made a pair of miniature bathtubs for the eyes, fitted them to the head like goggles, and fastened them securely in place by a strap around the head. He fitted each of the little bathtubs with an inlet at the top and an outlet at the bottom. Connecting the inlets by means of rubber tubes with a water reservoir or the faucet and turning on the water a stream of water flowed through the two bathtubs, washing the eyes and eventually draining through rubber tubes connected with the outlets, into a basin or the sink.

The inventor was thoroughly satisfied with the efficiency of this apparatus and so was the eye doctor for whom he made a copy of the device and who used it with excellent success in his clinic.

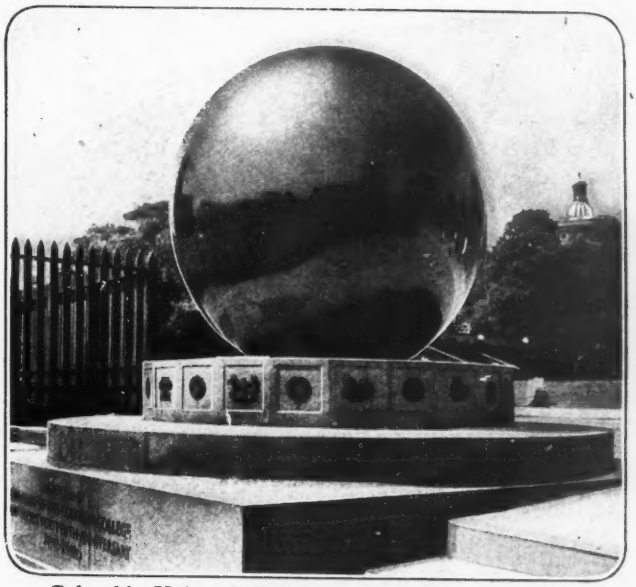
The device is of great value in all cases where a continued washing of one eye or both eyes is necessary. As the cups are provided with glass fronts, like goggles, the doctor can observe the effect of the washing upon the eye of the patient. The device can be used for but one eye or both, as desired, and the patient may be standing, sitting, or lying down.

The illustration explains, better than words can do, the method of using this apparatus.

Bathing both eyes at the same time

Making Soap from Table Refuse

TO conserve the fats contained in the table refuse and dishwater of the soldiers' mess, the British military authorities installed grease traps. The fat collected in these traps averages more than one ounce for each man daily. The trap consists of a tin-lined wooden box, divided into two compartments by a partition which does not reach the bottom by about four inches. The dishwater and the table refuse are poured through a strainer into the vat. As the water cools, the fat forms a crust on top and is skimmed off.

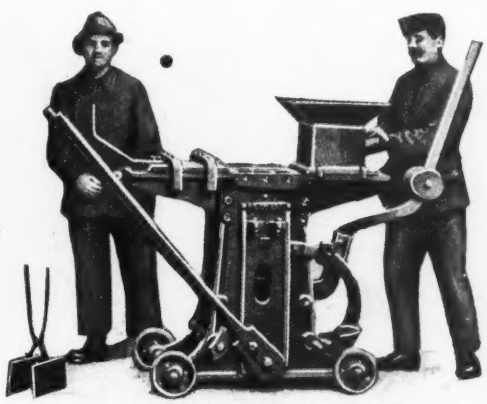


Columbia University's fifteen-ton sundial. You can't set this timepiece ahead an hour to save daylight

This Press Can Make Two Thousand Bricks of Fuel a Day

THE scarcity of coal in all belligerent countries has imposed upon all nations the necessity of exercising great economy in the use of fuels. Long before the war economic reasons made it desirable to find some method of utilizing coal dust, sawdust, peat and lignites for heating purposes. Briquettes were invented and to some extent used. The war revived the interest in briquettes, and several new presses for making them were invented.

The device shown in the picture is by a French maker who claims that one of these machines, operated by three men, can turn out from fifteen hundred to two thousand briquettes daily, each weighing about six and a half pounds. Briquettes may be made of coal dust, sawdust, shells of nuts or cacao beans, leaves, peat, etc.

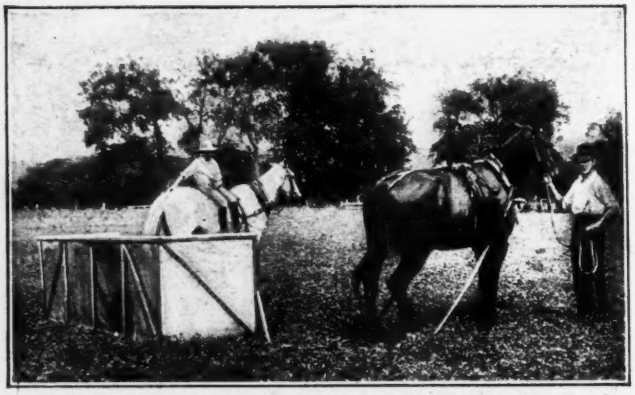


A fuel-briquette machine which can turn out about two thousand briquettes a day

Giant Granite Ball Tells Time with Great Accuracy

A HUGE shining ball of green granite, weighing more than fifteen tons, is placed at the edge of the campus of Columbia University, New York city, for use as a sundial. It is set on a solid stone base on the upper surface of which are mounted two curved brass plates. The edges of the oval shadow cast by the ball fall along the two brass plates and a comparison will give the correct time. Professor Jacoby, of the astronomy department, has estimated that the degree of inaccuracy of the sundial is never more than a fraction of a minute.

The monumental ball was a gift of the class of 1885 to commemorate the twenty-fifth anniversary of their graduation. Professor Jacoby, realizing the possibilities of rendering the ball useful as well as ornamental, had the two calibrated plates attached.



When this canvas-covered frame is hauled across the field, it bewilders the grasshoppers so they hop into it

Catching Grasshoppers by the Bushel

IN a Western State where grasshoppers threatened entirely to destroy farm crops, an inventive farmer made the grasshopper-catcher shown in accompanying illustration. The device consists of a framework over which is stretched canvas. On lower front section the teeth of a mowing machine are mounted to form a "catcher." As the contrivance moves over the field the insects jump and are caught by the catcher. A horse pulls the grasshopper catcher along.

How a Woman Makes Money by Putting Nature Under Glass

A YOUNG woman, dressed for "hiking" and walking with a brisk and elastic step, is approaching from the direction of the town. Her eyes, clear and keen, searchingly wander from one side of the road to the other. At a sandy strip she leaves the roa and begins to gather some of the graceful, feathery whisps of black grass growing there. She chooses critically and uses great care in placing the grass in the tin case which she carries by a strap over her shoulder.

A short distance beyond that sand lot, a marshy meadow attracts her attention. Boldly she wades into the swamp and seems pleased when she finds some of that dainty and delicate grass which is known as "fairy grass." On and on she wanders, stopping here and there to gather some purple, lavender or almost black grass, some fragrant Sea-Lavender, some early golden rod. Along the railroad tracks she gathers clumps of Poligonella, our cousin to Scotch heather, and every now and then she makes use of the net which she carries to capture some tiny butterfly with gorgeously-colored wings.

Who is this woman? Why does she collect these specimens, many of which seem so unattractive and commonplace? If you have taken your stroll in the vicinity of Lexington, Mass., you will recognize her as Miss Rose Whitney Smith, who has turned the pleasures of a naturalist's work to practical use and has built up a flourishing industry in which grasses, flowers, butterflies, etc., are skilfully employed for decorating trays, mirrors, screens, etc. The specimens are carefully prepared and arranged artistically upon a background of silk, protected on the one side by plate glass, on the other by a substantial wooden or metal back.

Miss Smith in her "Nature Shop," and, in the frame, a sample of her artistic decorative work

Ornamental Concrete Pools Take Place of Old Swimming Hole

THE delights of outdoor swimming in summer are made possible in cities by the building of concrete swimming pools. The expense is so small that even residences can afford them. When set among forest trees, a concrete swimming pool is an attraction. Water may be secured from natural springs or streams.

The concrete pools are easily waterproofed by proper construction. The main point to avoid leakage is to use good material so proportioned as to get a dense mixture; this, when well tamped, makes walls and floor water-tight or practically so. Concrete pools are proof against corrosion, and if well built are practically permanent. Therefore the cost of excavating and construction may be considered practically the only expense. Ornamentation consisting of balustrade and columns will, of course, increase the expense.

Concrete swimming pools bring delight to city-confined youngsters of all ages. The cost of construction is the only expense

It is in the inland city where the youngsters never get a chance to splash about except in the bathtub or some abandoned quarry that the concrete swimming pool is most appreciated.

The best type of pool for such places is exemplified at Austin, Texas. This pool is 200 feet long and 100 feet wide. For the first twenty-five feet it has a depth of twelve to eighteen inches, and accommodates scores of small children. In the next 150 feet the depth ranges from three and one-half to four and one-half feet, while the depth of the last 25 feet, for diving, is eight feet. The pool is constantly filled with filtered water, supplied at the rate of five hundred gallons a minute.

Making Use of Tomato Seeds and Skins

TOMATOES are used in enormous quantities in the United States for food purposes and as a condiment, and the industry of canning tomatoes and that of making catsups or soups of them has developed to considerable importance. In the making of soups and catsups only the pulp of the tomatoes is used and heretofore the skins and seeds were discarded as useless.

Recently economic chemistry has called attention to the possibility of utilizing both the skins and the seeds of the tomatoes. From the seeds 17.3 per cent of oil can be obtained, which has an agreeable smell and taste and a caloric value equal to that of olive oil. When treated with driers it acquires good drying properties, and is also useful in soap making. The seeds from which the oil has been removed and the skins of the tomatoes can be pressed into cakes which have considerable value for feeding cattle. Or the mixed mass may be spread for fertilizing purposes. Its manurial value was found to compare favorably with barnyard manure in potash, phosphoric acid and nitrogen.

Considerable work has already been done in Italy and other foreign countries toward utilizing tomato refuse and in the Italian province of Parma about 12,000 tons of skins and seeds are worked up into oil and fertilizer every year. In the United States, however, this matter has not yet received proper attention. Stress of necessity, however, gradually calls attention to the value of many things formerly regarded as useless.

Housekeeping Made Easy

A steam cooker set over the ordinary teakettle for canning fruit

Comb cleaner made up of threads in the form of a razor stropper. It may be washed when necessary

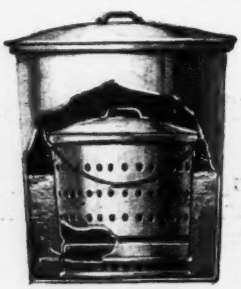
An attractive holder for the whisk broom. The broom forms a Fiji skirt for the girl

A double egg-beater of new design driven by a Pomeranian

An ash barrel truck that can be pushed up and down the steps

An electrically operated ironing roll for the home laundry. It is heated by gas

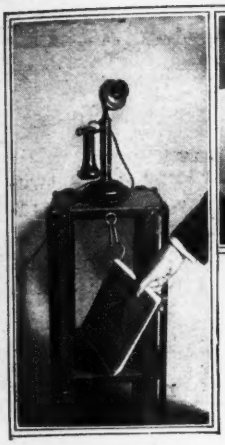
A convenient chair for telephoning at the home or office



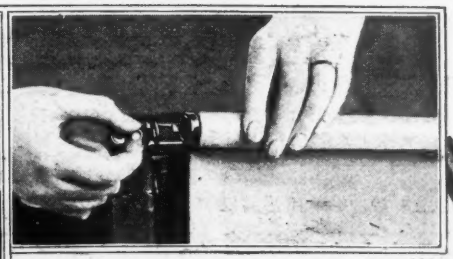
A double boiler, with removable bottom, for cooking rice and other cereals

A kettle cleaner which has brush and scraper on opposite sides

Housekeeping Made Easy



A convenient hanger for the telephone book which snaps into the hole in the book



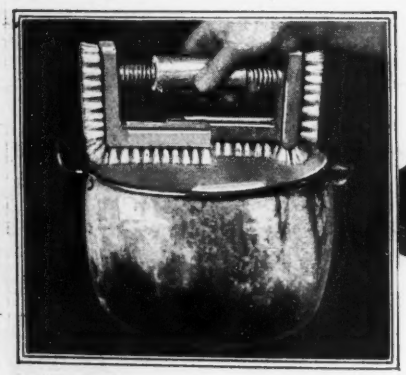
Adjustable brackets to make curtain poles fit any window

An electric washing machine which works on the vacuum principle

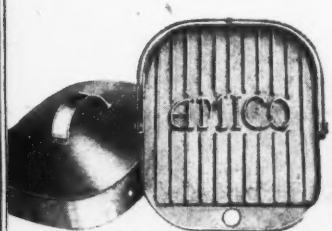
A cake tin with a detachable rim for cakes of all sizes

A smoking stand with ash tray of original design

Illuminated push buttons on an electric light switch—coated with luminous paint



A new design of a pot-cleaner which is shaped like a hat-stretcher



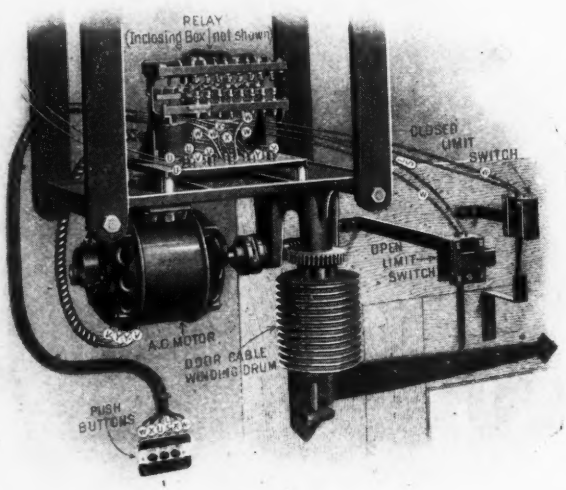
Grill or broiler for cooking steaks over a single-flame gas burner

This little attachment tilts the chair as desired

Garage Doors that Save Space and Time

Some fold up like a screen; some swing around a corner; and some can be operated merely by pushing a button

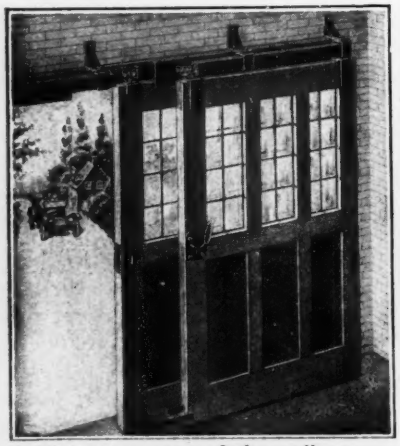
EVENTUALLY, the automobile owner who builds his own garage is confronted with the problem of selecting a door which will require as little inside space as possible and yet give the least trouble in opening and closing. The old-fashioned swinging doors, like those in our dwellings, are not space-saving enough to suit modern conditions. Whether they open inwardly or outwardly, they require altogether too much space for their operation.



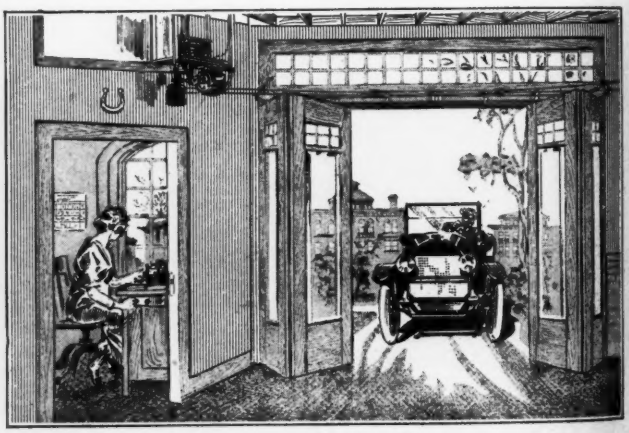
This electrical device will open or close the garage door. The clerk in the office can do it by pressing a button

Numerous ways have been devised to overcome this difficulty. One of the simplest plans is to make the door of several narrow parts hinged together in such a manner that they fold up like a screen. A door of this type, for a two-car garage, is shown in one of the illustrations accompanying this article. In that case the door is divided into five hinged parts. The illustration clearly shows the manner of operating it.

There are many kinds of sliding doors. One of the pictures illustrates one in two parts working like the sliding doors of show cases. Another kind shown is the sliding door which is swung around the corner. Both these types require but little space for opening and closing, but they must be mounted on roller-bearing hangers if they are to be operated without too great exertion by a woman or child. Types of such hangers are shown in the accompanying pictures.

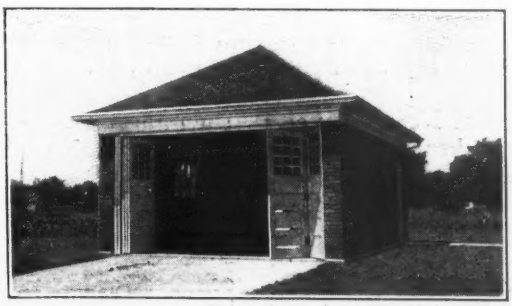


This shows one of the ordinary sliding doors with two parts



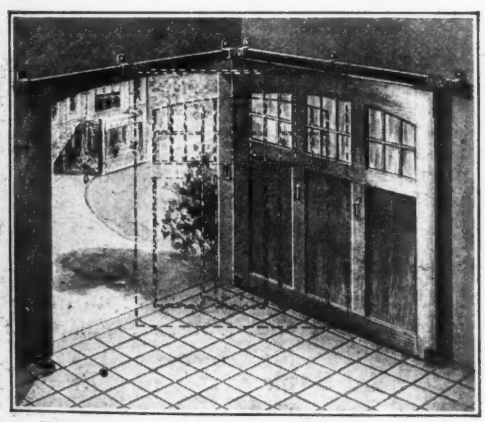
The doors of this garage fold up like screens and are operated by an electrical control from the garage office

The doors of large public garages have to be opened very frequently and at all hours of the day or night. This necessitates constant attendance upon them. The device shown in one of the illustrations enables the clerk or stenographer in the garage office to open or close the heavy garage doors without leaving her desk, simply by pressing a button. The device consists of a small electric motor geared to a cable-drum. The current is controlled through a set of push buttons and a relay. When the starting button is pressed, the current is sent through the motor which operates the drum and, by winding up the cable, pulls open the door until a metal contact on the door itself comes into play against a switch-bar, supported by the small overhead frame that carries the motor. This shuts off the current and leaves the door open. To close it, a second button is pushed and the door is closed in the reversed order, with a similar switch to shut off the current when the door is closed.

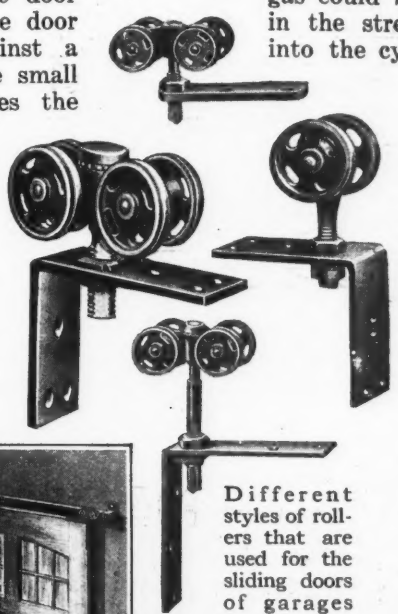


This garage has folding doors that slide in grooves and require little "elbow room"

It is self-evident that the ease with which large doors may be operated depends primarily upon the nicety with which all parts are fitted and upon the quality of the materials used. An ounce of prevention being worth a pound of cure, it would be poor economy to resort to inferior labor or material to save a few dollars on the initial expense, only to have to pay a repairman a more or less heavy bill after a short time.



This sliding garage door swings around the corner and requires very little inside space



Different styles of rollers that are used for the sliding doors of garages

An Automobile that Got Its Power from the Street Mains

AN automobile provided with a compressing plant by means of which gas could be taken from mains in the streets and compressed into the cylinders, in which it was stored as fuel for the machine, is the work of W. H. Dunkley of Birmingham, Ala. The plan included the employment of charging stations erected in the streets. Payment for the gas could have been made by means of slot meters and gas pass keys.

The Dunkley automobile was made in the early days of the use of coal-gas as a fuel for machines. It had a twin-cylinder opposed horizontal engine and the portable gas compressor was made up of two water-cooled cylinders at right angles to and above the power cylinders. The cylinders in which the gas was stored were of the standard type used for oxygen.

An idea for fitting hollow disk wheels as auxiliary reservoirs for gas was also evolved by Mr. Dunkley.

Building a Subway Under a Subway

Little do New Yorkers know that they are traveling on a suspended subway even though it is underground

By Howard B. Gates, C. E.

MANY residents of New York city no doubt remember the time when the possibilities of subways as a means of rapid transit were as little realized as the practical application of the airplane, in its present development, is now considered, to our everyday life. But within the last fifteen years a most wonderful system of subways, comprising more than two hundred miles of underground railroad, has been built in New York under enormous difficulties at an expenditure of more than $400,000,000.

Statistics show that nearly 2,000,000 persons are carried by this system every day and that more than seventy-five per cent. of this number seek its accommodation between the hours of six and nine o'clock in the morning and between four and seven o'clock in the evening. One of our largest railroad systems, with some 26,000 miles of track and traversing thirteen states, carries but one-third of this number. During "rush" hours, even standing room is at a premium, although ten-car trains, each carrying 2,000 persons, are operated under a one-and-one-half-minute headway, controlled by elaborate electrical signal and emergency stop devices, all of which must operate perfectly to make this service possible.

The difficulty of constructing such an important and complicated system through any of New York's busy thoroughfares, loses much in a comparison with the difficulties of building such a structure beneath an existing and operating subway, without entering or disturbing the structure above. Although the average weight of the subway may not be more than a ton to the square foot, there are points, at the columns for instance, where concentrated loads of two hundred or three hundred tons, together with adjacent heavy and rapidly moving trains, make any disturbance to the equilibrium or stability of the temporary or permanent supports a matter of considerable responsibility and concern.

Such a piece of work is now in progress beneath the present Times Square station at 42nd Street and Broadway, passing diagonally beneath that station for about 250 feet of its length. Any interruption to operation at this point would congest the entire system, and yet, under a considerable portion of that structure, the original foundations have been supplanted by a complicated system of steel beams and timber supports. Traffic is maintained and the 300,000 persons who use the subway daily at that point do not even know what is going on beneath them. The new structure also has four tracks, two local and two express tracks, and will be operated by the Brooklyn Rapid Transit Company. Connecting passageways will lead from the transit company's present, recently completed station on Broadway between 40th and 42nd Streets to the Interborough station above.

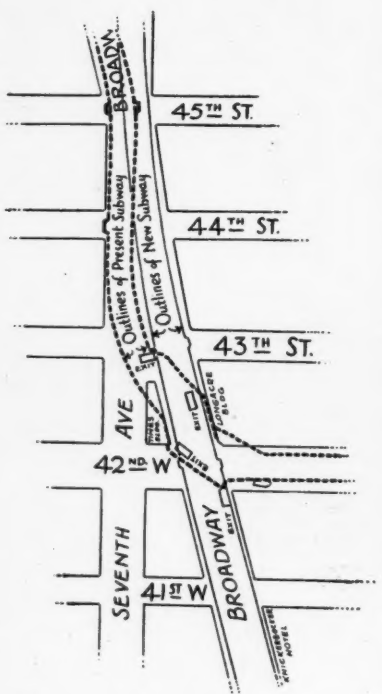
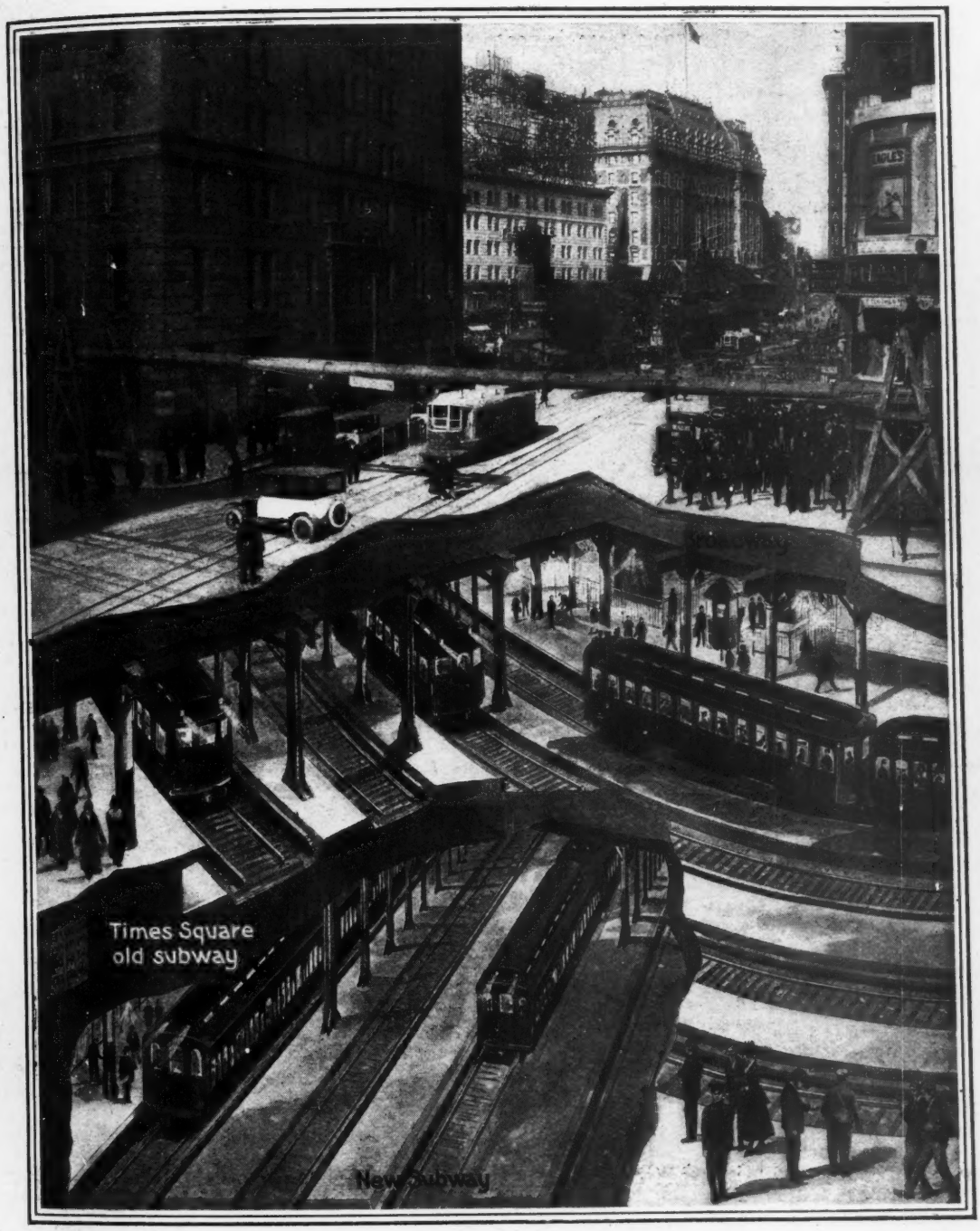


Diagram showing relative locations of the old and the new subways

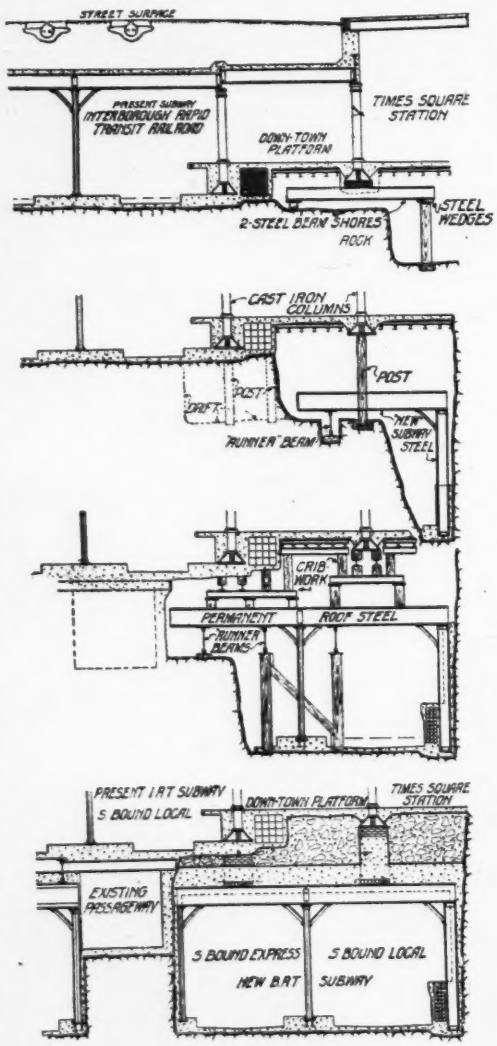


New York's Two-Storied Subway

While train after train, loaded with passengers, ran into Times Square station of the New York subway and out again, and while millions of persons, on foot and in vehicles of every character passed over the spot on the surface, a new, four-track subway, to be operated by the Brooklyn Rapid Transit Co., was constructed, crossing 42nd Street under the tracks of the old subway. Can you realize the tremendous difficulty of the engineering task involved in the gigantic undertaking? Read how it was done.

Eliminating all but the most vital technical details, the problem becomes one of blasting the rock from beneath the present station over small areas, which are self-supporting and which are subsequently shored by steel beams and timber supports before any further progress is attempted. To allow for the blasting and removal of the rock without endangering, to any serious extent, these temporary supports, the arrangement of the shoring must be changed from time to time until enough of the new structure can be finished safely to sustain the structure above. The support is arranged temporarily until the new work is completed, whereupon the permanent footings of masonry are placed.

By referring to the illustrations, it will be seen that, while a meshwork of light steel beams resting on posts or other temporary work serves to support the platform and lighter portions of the station, the shoring of the platform columns, each of which is computed to carry a load of about two hundred tons, has to be advanced in slow and expensive stages. The cast-iron bases of the columns are first carefully exposed and enough of the foundation concrete and rock removed to allow placing large steel beams beneath sides of base.



How It Was Done

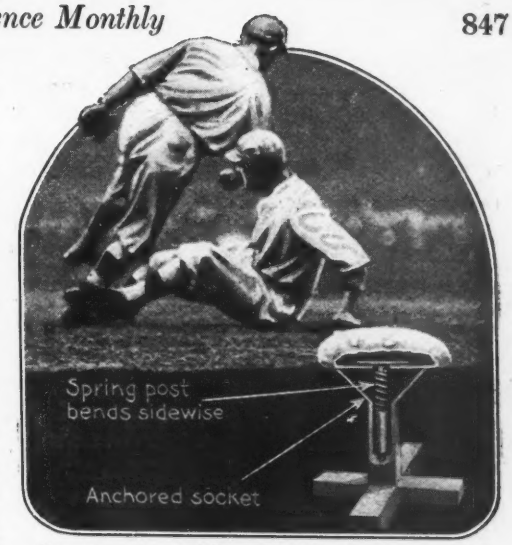
The top diagram shows the first step. Large steel beams were placed under the partly exposed columns of the old subway as a shoring and wedges hammered in until the weight was lifted. Then these were replaced with a single heavy timber post, directly under the original column. As the new steel-work progresses and is filled up with concrete all the shoring is taken away until at length the structure stands complete, one subway on another

Wherever the headroom or working space is sufficient, these beams are supported on well-placed timber columns beneath which steel wedges are driven, until there is a visible separation between the cast-iron base and its original foundation, indicating that the full load of the column above has been transferred to these temporary supports. The rock foundation is then removed to about a foot below the roof of the new subway, whereupon a single square timber post, accurately centered under the column and wedged to take the full load, replaces the shoring beams and releases them for use at other points.

Working at the new subway roof level, small rectangular cuts or "drifts" are excavated and timber posts placed for the support of the structures above. Where the character of the rock permits, the excavation is next made to a depth sufficient to assemble a portion of the new structure. Where the full depth cannot be excavated without endangering the supports, long "runner" beams, upon which several sets of roof girders are placed, are set in concrete bearings upon the rock. Another "pick-up" of the platform column is now made by means of a cribwork of steel beams and blocking, built up from the permanent roof steel.

The method of procedure in excavating, as described up to this point, has been in the direction of the width of the new structure, but with the "runner" beams in place, the work progresses in the direction of these beams. As fast as the rock is removed beneath the "runners," posts are placed to carry the free end and, with the other end supported on the original rock, the remaining foundation can be removed with little danger to the subway overhead.

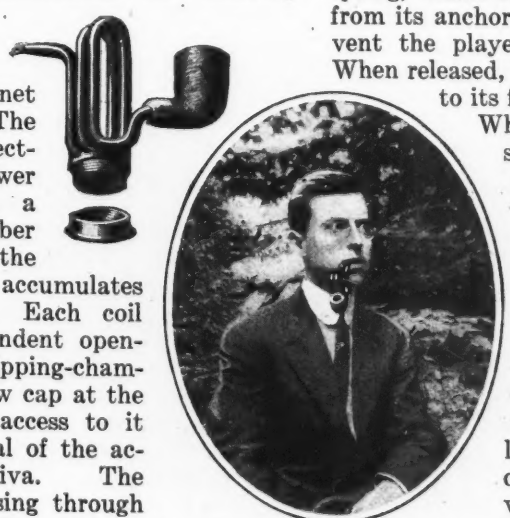
The new structure is next completed, whereupon all temporary shoring and supports are removed and the subway above is restored upon the roof of this new work, filling all voids between the two structures with masonry. It goes without saying that the work is carried on from the adjacent unfinished portion.



The base is rigidly anchored to the ground; yet it "gives" slightly when the runner hits it

This Tobacco Pipe Is Built Like a Cornet, But Isn't Musical

A TOBACCO pipe of unusual design has been invented by Warren Murray Baechtel, of Hagerstown, Md. Every pipe-smoker knows that the longer the stem of his pipe the cooler will be the smoke. Pipes with stems a few feet long have been in use in different countries for many years, but their awkward length precluded their use outside of the house. The inventor of the pipe shown in the illustration circumvented the difficulty by coiling the stem of the pipe like the tube of a cornet or signal horn. The coils are connected at their lower end to form a dripping-chamber for receiving the saliva which accumulates in the stem. Each coil has an independent opening into the dripping-chamber and a screw cap at the bottom gives access to it for the removal of the accumulated saliva. The smoke, in passing through the coils of the stem, is drained several times of saliva and nicotine.



The long, coiled stem, without being awkward, insures a nice cool smoke

A Baseball Base Which Moves When It Is Hit

AN improved baseball base, which is anchored to the ground so that it is secure and yet is able to yield, has been invented by Sydnor M. Falconer, of Washington, D. C. Bases, as they are now fastened to the ground, are often torn from their moorings, or they are so immovable that they injure the player when he strikes them at great force. The base described is provided with a coiled spring, which enables it to move slightly from its anchored position and thus prevent the player from getting injured. When released, the base returns instantly to its former position.

When a base-runner comes sliding, hands first or feet first, with considerable speed against an immovable base, he is very apt to sustain a sprain or other serious injury. This device should therefore appeal to those players whose ambition frequently makes them risk their limbs in the base stealing of bases. A similar device, which would make the football-player's anatomy bend instead of break on contact, is desirable.

The cane, with sewing-bag attached, is stuck into ground near chair, leaving you unencumbered

Red Cross Knitters and Sewers, Please Learn How to Use a Cane

IF you enjoy sewing out-of-doors, but object to a lap-full of the necessary materials, here is a little device which will make sewing in the garden an unalloyed pleasure. And best of all, you may not have to buy a single article in order to have this attractive combination sewing-bag and table.

Take a cane and attach to it a cretonne bag about twelve inches long, and divided into two parts. Stick the cane into the ground, and you can sew as comfortably as if you were indoors.

Soap and Fertilizer from Dead Locusts

LOCUSTS are plentiful in Uruguay and the farmers of that republic are compelled to keep up a constant war against them. Millions of these destructive insects are killed every year. Recently it was learned that soap, fertilizer and lubricating oil may be obtained from the dead locusts, and in the future they will be utilized for that purpose.

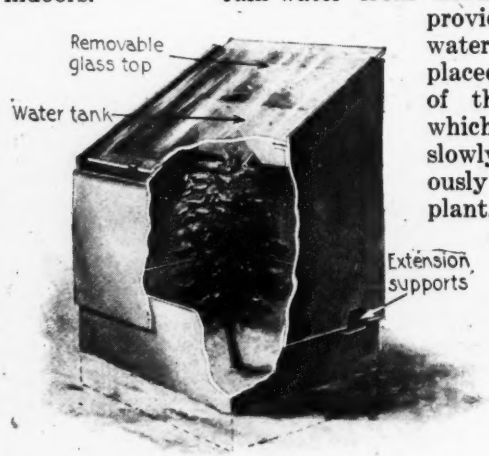
A Soap Bubble Can Be Made to Last for Months

THE air of an ordinary room is filled with tiny particles of matter which fall on the airy soap bubble, alter the surface tension, and—poof—it is gone. The effect of these minute particles on the stability of bubbles was first brought to light by Sir James Dewar. He experimented in clarified air until he was able to produce bubbles which lasted for months. He has even produced a soap film, which was a year old recently and which seems to remain just as it was made.

So tell the children that the secret of successful soap bubbling is to have a perfectly pure soap-solution and to blow the bubbles in and with air that is also perfectly pure.

Individual Protective Housing for Delicate Plants

FOR the protection of transplanted hothouse plants, Mr. John C. Mueller of St. Louis has invented a device which may be described as an individual protective housing with hothouse and irrigation features. The box-like device with a slanting top is placed over the plant which needs protection and is secured by pressing the lower edges of the structure into the ground. A removable top with strips of glass and ventilated by holes with raised edges, calculated to keep the rain-water from flooding the plant, is provided. If desired, a water tank may be placed in the upper part of the housing, from which water may be slowly supplied continuously to the growing plant. In case the growth of the plant should make it needful, a second or even a third story may be placed upon the original structure.



This device protects the delicate plant from excessive cold, heat, rain, and wind

Who Won the Motor Contest

An interesting collection of labor-saving devices brought forth in the Popular Science Monthly's prize automobile contest

THE POPULAR SCIENCE MONTHLY'S motor contest has been a huge success.

The first prize of $100 goes to Mr. C. A. Butterworth of Newton Center, Massachusetts; the second prize of $50 goes to Mr. P. C. Haas, of Ann Arbor, Michigan. Both prizes were won by young men in whom invention seems to be a cradle-gift, for neither makes his living as an engineer.

On the left, Mr. P. C. Haas, winner of the second prize of fifty dollars. On the right, Mr. C. A. Butterworth, winner of the first prize of one hundred dollars

It is significant that both prize-winners made use of the electric current to carry out their labor-saving ideas. Electricity is playing an increasingly important part in reducing the muscular labor required to drive the car. We have only to cite the electric starter and to contrast it with the old laborious hand-crankers to drive home the point; or to mention electric lights, turned on and off by a switch from the driver's seat, thus eliminating the flickering oil lamp or the gas lamp with its leaking pipe; or the electric water temperature controller which insures efficient engine operation as against no controller at all; or the electrically operated gear shifter as against the hand shifter; or the score of electric comfort-giving accessories.

Mr. Butterworth, the first-prize winner, is a young man who has had no academic mechanical training and who has not even had a lesson in mechanical drawing. He has worked out an electrically controlled hydraulic gearshifter with an automatic clutch throw-out. It eliminates the physical exertion expended in the present type of car whenever it is necessary to shift gears. In addition, it does away with the physical labor required of the foot to push down on the clutch pedal and to disconnect the engine from the driving mechanism whenever the gears are to be shifted.

It was our intention to publish complete drawings of Mr. Butterworth's invention in the present issue of the POPULAR SCIENCE MONTHLY. We find, however, that the time at our disposal is too limited for an adequate presentation of the subject. Hence we must ask our readers to wait for the July issue, in which full justice will be done to Mr. Butterworth's ideas.

The winner of the second prize of fifty dollars, Mr. P. C. Haas, has invented an electrically operated steering gear controlled by means of a small switch mounted on the steering wheel, retained for looks and for cases of possible emergency. The task of guiding a car saps both the physical and nervous energy of even the most hardened driver. Mr. Haas' invention, therefore, reduces the effort of merely following the right path by a percentage which cannot easily be calculated. It is our intention to publish Mr. Haas' invention with full plans and specifications in the August issue of the POPULAR SCIENCE MONTHLY.

Both Mr. Butterworth and Mr. Haas are to be congratulated on the success of their ingenious ideas.

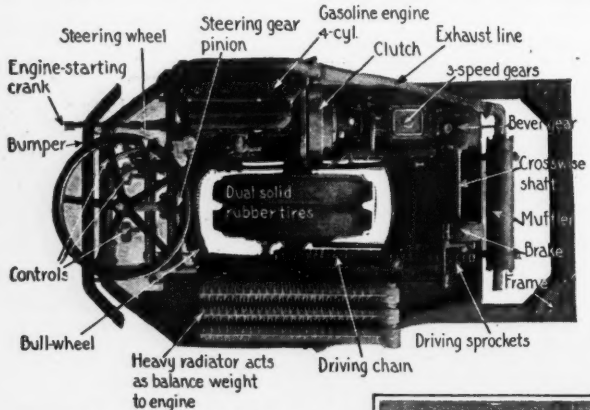
Maybe you have special needs. Write to the editor about anything within the scope of the magazine. He will be glad to help you.

A One-Wheeled Motor Tractor

A concrete illustration of how the difficulty was solved of making one wheel replace two

THAT a one-wheeled tractor possesses certain real conveniences over a two-wheeled affair has long been recognized, but the problem of working out the practical difficulties encountered were many and not easily overcome. The accompanying illustrations show an ingenious solution of this problem, and give a comprehensible demonstration of how the various difficulties were overcome. Some

For hauling guns over narrow trails or broken ground this tractor would be better than army mules

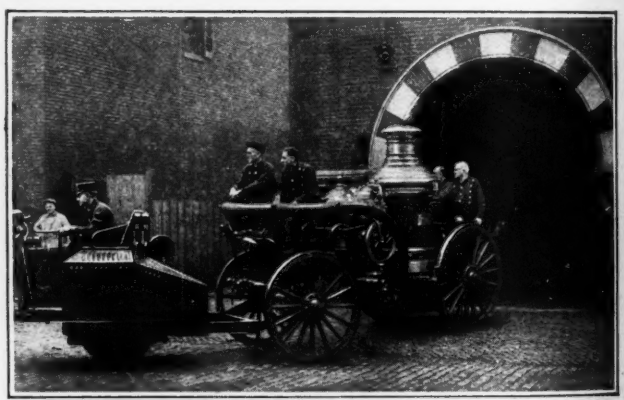


Showing the interrelation of parts in the one-wheeled tractor, and its compactness

of the problems encountered were the difficulty of transmitting the power from the engine to the driving wheel without a heavy and intricate system of gearing, of gearing down the engine revolutions in order to give greater power at the driving wheel, of providing means for changing the gearing as the conditions of load or road might demand, and, finally, of getting all these mechanisms into a compact space and of making it possible for the wheel to turn a complete circle of three hundred and sixty degrees in order to meet abrupt turning conditions.

All of these problems seem to have been solved in the one-wheel tractor shown on this page, the various mechanical contrivances for power transmission and gear-shifting being shown in the diagrammatic picture, and the attachment of the tractor to a fire-engine being pictured in another. The illustration at the top shows how the tractor could be made to do its bit in the game of war by hauling guns over roads not passable by larger motor vehicles.

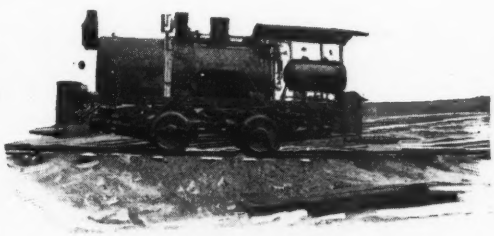
The model has a four-cylinder gasoline engine, three-speed gears, a heavy radiator, and every part of the mechanism heavily reinforced. The tires are solid rubber.



The old fire engine is attached to the tractor simply by changing from the pole and whipple-tree to a yoke

An Ideal Industrial Locomotive: No Smoke, No Steam, No Coal

WITH coal scarce and gasoline high-priced and much in demand for all of our war activities, the oil-fired steam locomotive, burning heavy grades of distillate or crude oil, is now winning favor in plants where switching engines haul goods over short distances. The oil-fired locomotive has many uses. It is found hauling logs in camps far away from coal supplies; or wending its way on sugar plantations; or busily transporting from the excavations for New York's new subway system muck, rails, ties and ballast. Contractors select the oil-fired locomotive because it does not pollute the atmosphere with smoke.



Note the oil-tank in front of the boiler, which replaces the cumbersome coal-tender

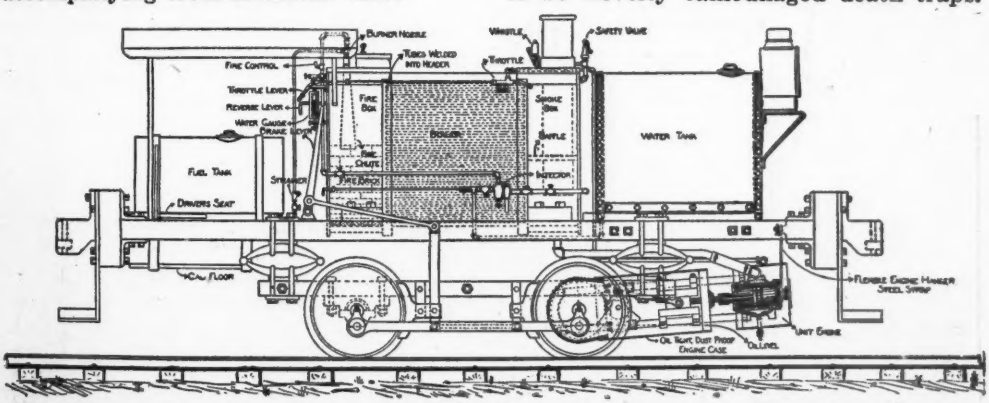
In appearance, the fuel-fired locomotive, as shown in the accompanying illustrations, does not differ much from the familiar coal-fed type, except that a separate tank out in front of the boiler takes the place of the usual coal-tender. The cost of operation is said to be less than one cent a ton per mile. The construction is clearly shown in the accompanying cross-sectional view.

Death Traps in Seemingly Unoccupied Fields at the Front

THE precautions taken by the officers of the allied forces in order to prevent their men from falling into German traps during the excitement of an attack are brought out in a statement made by Major-General Charles M. Clement, of the United States Army, who visited the firing line in France.

"When I studied army tactics some years ago," he said, "we had five points, represented by the five fingers of our hand, and there was nothing said about killing anybody. But an army order today reads: 'The object of this attack is (*a*) to kill the Germans; (*b*) to reach hill number so-and-so; (*c*) to stop at hill number so-and-so'; and woe betide the man who goes beyond the stopping point!"

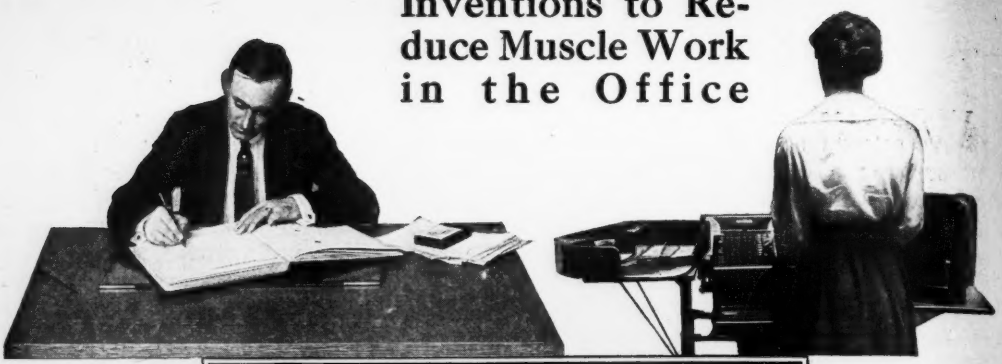
These explicit instructions were given, General Clement explained, because the enthusiasm of the French and British soldier frequently urged him beyond the objective; and fields back of that, which appeared to be unoccupied, often proved to be cleverly camouflaged death traps.



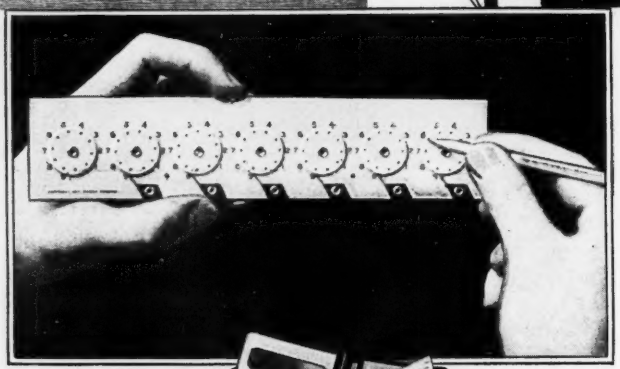
The new industrial oil-fired steam locomotive in cross-sectional view. Each part is plainly indicated, showing the compact construction of this coal-saving iron horse

Those of us interested in science, engineering, invention form a kind of guild. We should help one another. All the specialized knowledge and information of the editorial staff of the Popular Science Monthly is at your disposal. Write to the editor if you think he can help you. He is willing to answer questions.

Inventions to Reduce Muscle Work in the Office



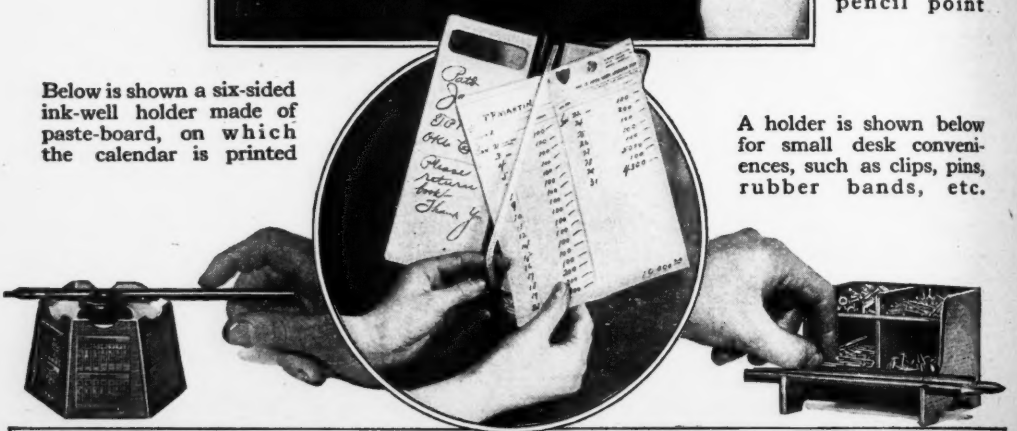
A blotter book for letters. They are blotted after being signed, by turning the leaves. This does away with the blurring of the signature when letters are turned over on one another



A tray for checks and deposit slips to keep them from becoming scattered while the clerk posts them

A computing machine with seven adding wheels worked by hand with a pencil point

Below is shown a six-sided ink-well holder made of paste-board, on which the calendar is printed



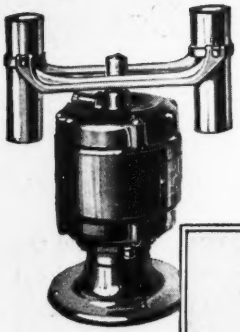
A holder is shown below for small desk conveniences, such as clips, pins, rubber bands, etc.

Six clerks, at this specially equipped table, handle 6,000 Pullman-car reservations daily

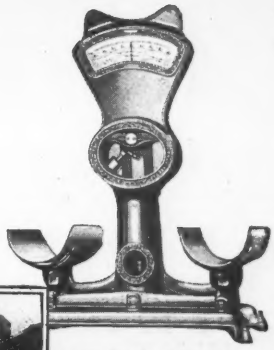
In the circle is a loose leaf pass-book in which entries can be made by machine or pen

A railroad company uses this itinerant bank to pay off 2,500 employees a month

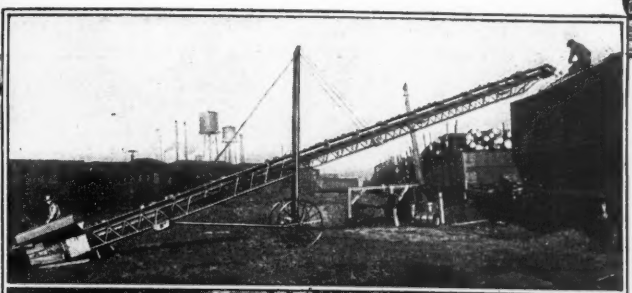
Do It by Aid of These Labor-Saving Tools and Machines



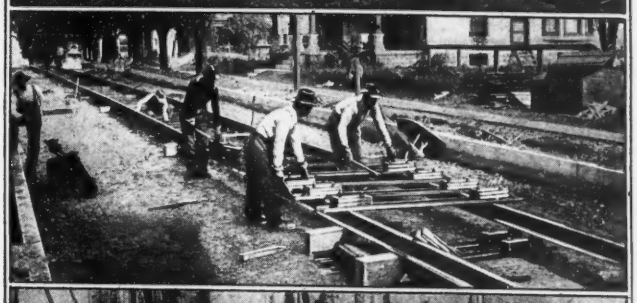
This electrically driven centrifugal milk separator is a great help in making tests of butter



Scales which register the accurate weight of shells and shrapnel

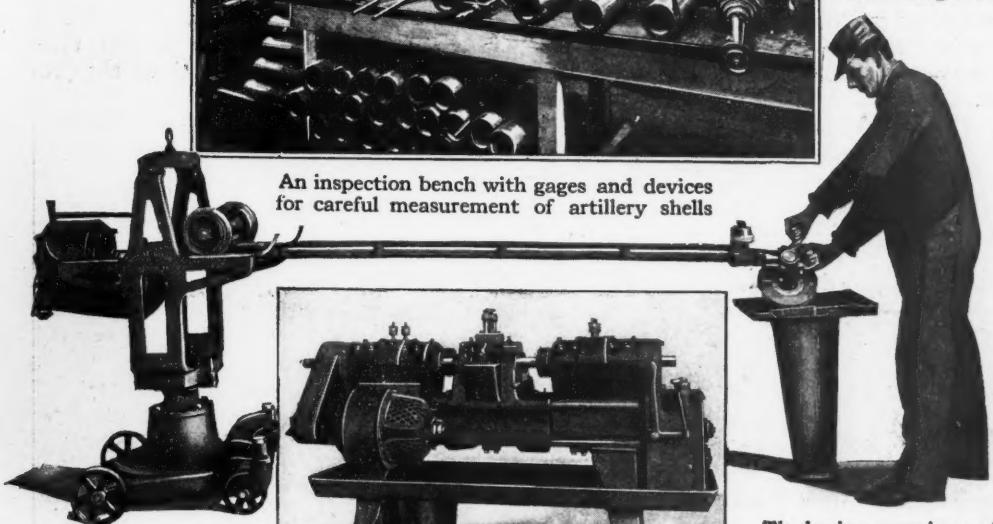


The upper center picture shows a belt conveyor for loading crushed stone, etc., into cars

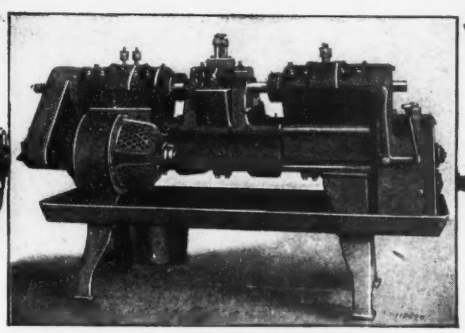


The center picture shows a railway tie with a wood block and asphalt cushion base to take up shocks

The portable radial grinder shown below is used for general light grinding and buffing work



An inspection bench with gages and devices for careful measurement of artillery shells



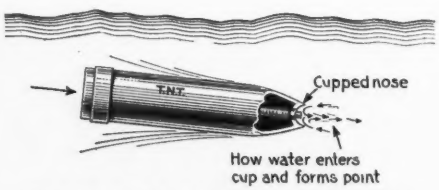
The boring, reaming and facing machine shown at the left does accurate work on automobiles

Sinking U-Boats with a Sub-Sea Barrage

The Isham shell, which does not ricochet, is the latest destroyer of the submarine

By Robert G. Skerrett

THE diving shell is the latest thing for attacking hostile submarines. It is the depth-bomb improved and therefore more potent. Indeed, in the opinion of many experts the diving shell is the most formidable instrument yet devised for battling with the foe's U-boats. It is an out-and-out American invention and the climax of years of study and development on the part of its originator, Willard S. Isham.



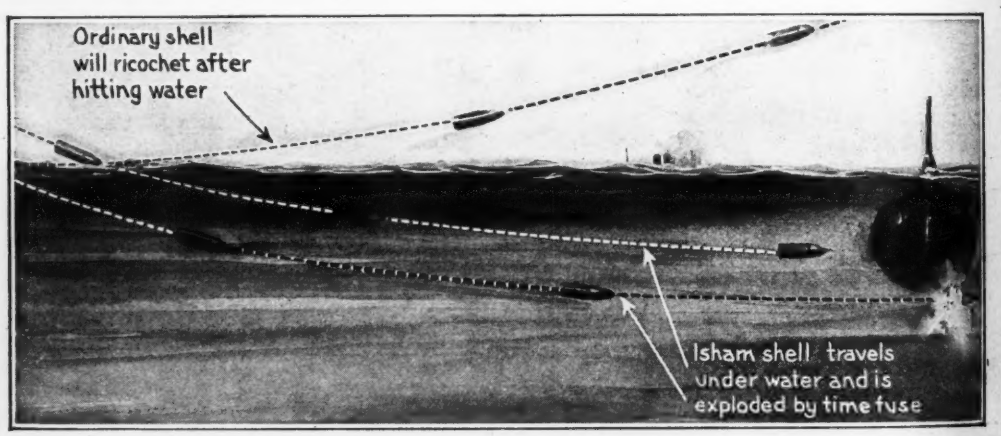
High-angle firing makes the shell strike the water at such an angle that it will dive into the sea instead of ricocheting

Of depth-bombs there are several sorts, but of diving shells there are only two kinds—a foreign adaptation of the Isham missile and the Isham projectile, pure and simple. The reason for this is that the French and British governments have been more alive to the merits of the American invention than our own ordnance officials, and, as a result, have actually been the first to apply the diving shell to wartime service. We are catching up, however, if reports from Washington can be accepted at their face value, and the so-called "non-ricochet shell" is likely soon to have its place in the magazines of all of our destroyers operating in European waters.

High-Angle Fire and Its Drawbacks

The British and French vessels that are armed to throw their form of diving shell resort to high-angle fire, the projectile traveling a course much like that of a missile discharged from a mortar. In this way, the shell strikes the water at an angle sufficiently blunt to obviate ricocheting and to insure penetration into the sea. Once the missile has plunged beneath the surface its explosion is automatically regulated. The detonating fuse is set to operate at a predetermined submergence as in the case of a depth-bomb.

High-angle fire from a moving craft at an object in motion has a number of drawbacks. First, there is the comparatively protracted flight of the pro-

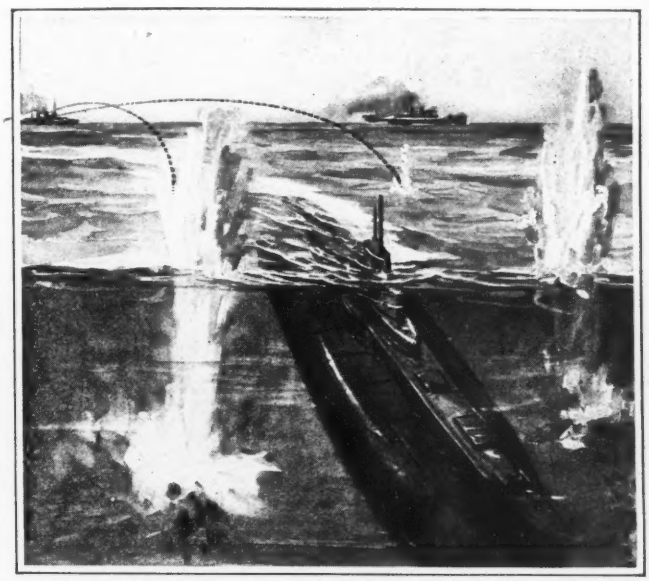


The explosion of the Isham shell beneath the surface is regulated automatically by a time fuse set to operate at a certain degree of submergence regardless of hydrostatic pressure

jectile; second, its prolonged exposure while in the air to the deviating sweep of the wind; third, the fact that a slight roll of the gun platform will greatly change the arc of travel and, therefore, the range of the shell; and, finally, that the target offered by either the periscope or the conning tower of a submarine under way is a mark that is very hard to "range" accurately.

These points are mentioned in order to emphasize the advantages of the Isham type of diving or torpedo shell which can be fired over a flat trajectory like any ordinary projectile from a naval gun.

The Isham torpedo shell was originally intended to attack the under-water body of an armored ship and thus to reach her vitals. In the invention's present form we see a shell especially and peculiarly suited for battling with U-boats at long range even though the enemy craft offer but the smallest possible mark—the exposed tip of a periscope. Three years ago the Isham shell was tested by a board of naval officers, and while the fuse did not function satisfactorily in its entirety it showed even then that the designer was working in the right direction. The projectile, however, demonstrated that its author, by employing an unusual type of nose, could make the shell dive, on striking the water, and thereafter pursue a submerged course at a gradually increasing depth below the surface.



The missiles fall all about the U-boat and form a veritable subaqueous barrage—an under-water curtain of fire

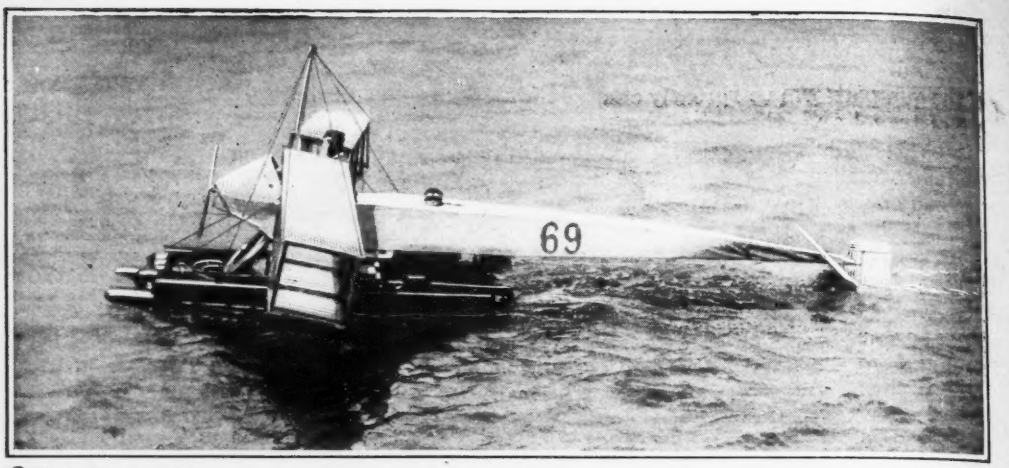
It Dives and then Explodes

The trial board reported that "a high explosive shell is an urgent necessity for naval use in addition to the armor-piercing shell now adopted." And the same commission stated:

> "It would be highly desirable to have a high-explosive shell having a fuse such as has been suggested by Mr. Isham, viz, to detonate a shell on striking thin metal, such as the side of a destroyer, but which in striking water would not detonate until after a period of approximately a second—this in order that a shell which struck short of a ship might continue its run under water and explode on contact with the under-water body or near it."

Since that time, Mr. Isham has developed a fuse that he declares will do all of the foregoing things and more, i.e., it will explode after a certain time, following a dive, even should it fail to meet an obstacle in its path, and if it hit a solid body, whether thick or thin, it will burst within one hundredth of a second thereafter.

When the projectile impacts with water the momentary checking of its speed fires a time element or "train" of powder which must be consumed before the flame reaches the primer which actually detonates the high-explosive bursting charge. If it hits either thin or thick plating, a percussion cap instantly sets off the principal mass of high explosive. Hydrostatic pressure does not interfere with the functioning of the fuse. The moment a submarine is seen from afar, the gun will be loaded with the Isham projectiles and hurled at the foe, the missiles forming a veritable subaqueous barrage and creating an under-water curtain fire one or two hundred feet short of the target, so that the shells may strike the body of the submarine and explode or, failing in this, be detonated like so many mines near by and wreck the undersea craft.



© Western Newspaper Union

This apprentice machine is named after the penguin because, like that bird, it can skim along the surface of the water, but is unable to fly. It is safe for the inexperienced aviator

The Penguin Seaplane—It Swims But Doesn't Fly

DO you know what a penguin is? You may have read of it but probably have never seen one. The penguin is an aquatic bird found in the polar regions. It is remarkable for its peculiar structure. It has only small stumps in place of wings and, for that reason, is unable to fly. But it is a good walker and an expert swimmer and diver.

The name of "penguin" has also been given to the training apparatus employed to teach prospective aviators the control of the airplane or seaplane. The name is well chosen. The penguin used for training is as unable to fly as its arctic namesake. It consists of an airplane with wings so small that the power of the motor is unable to lift the airplane off the ground or water. It is supplied with ailerons, elevator, rudder and wheels exceptionally strong for running on the ground. The apprentice is encouraged to run this "penguin" to his heart's content; there is no danger that it will take to the air. In a short time he graduates to a real airplane that can and does fly, and then he can give all his attention to the flying part without having to worry over the handling of the various controls. The sense of safety he enjoys while learning is a great nerve-sedative to the inexperienced aviator.

This Baby Caterpillar Tank Looks Dangerous But Isn't

THE miniature caterpillar tank shown in the accompanying illustration is not an instrument of war, nor is it intended to become one. It was made at the request of the Red Cross organization of Stockton, California, by a local manufacturer of caterpillar tractors, to be used as an attraction in a society circus, which netted nearly $10,000.

The exterior of the tank was patterned after the English tanks used on the battlefield. A motorcycle engine was put in to supply the power for the motion of the track chains. It was so arranged that either side could be disconnected or worked independently, thus permitting sharp turns.

A one-man tank built like one of the big English tanks, but intended for a less bellicose purpose

Deep-Sea Fishing with a Little Submarine

EVERY fisherman knows that some of the most desirable fish to be found in the ocean never run closely enough to the shore to be caught with line or net from one of the piers. These fish like deep water and the fisherman who wishes to catch them must go out to seek them in their haunts. That means a trip in a tug or a seaworthy launch, which is not always feasible.

F. H. Trimble of Los Angeles, California, has devised an original method of deep-sea fishing without leaving the shore or pier. He constructed a small boat, built somewhat like a submarine, equipped it with a small motor run by a battery stowed away in the hold of the little craft and installed a simple clockwork that shuts off the current after a certain time. The little boat, built of steel and weighing about twenty-five pounds, is driven by a small propeller at about four knots an hour. It runs on top of the water or underneath the surface.

To this boat two lines are attached. One line carries the hooks and bait, while the other line serves to pull the boat back to the shore or pier. The fisherman baits the hooks of his line, attaches it to the submarine and starts the little motor. The boat makes a bee-line for the deep-sea fishing grounds, taking the baited line with it. When it has reached the desired place, the clock shuts off the electric current, and the motor stops. When the fisherman thinks that every one of the hooks has its prey, he pulls in the line, hauling back to shore the boat and fish.

© Underwood and Underwood

My son, you may go out to fish, but don't go near the water

Breeches for Parachuting

IN order to check the constantly increasing number of fatal aeronautical accidents a humane inventor has patented a pair of parachute breeches. Will they prevent your being dashed to the ground? We don't know. The fabric, cut, and workmanship are matters of choice, and your tailor will be pleased to suit your particular form and taste.

For those who intend to be measured for a pair of parachute breeches in the near future, we give a list of instructions which should be followed when you find it necessary to use them:

1. Remove your dining-room table.
2. Lay the parachute open on the floor.
3. Fold back the larger one and insert your legs in the smaller one.
4. Pull up and buckle trousers.
5. Adjust shoulder straps.
6. Tighten garters.
7. Gather all folds and swish them around to your back. Allow the train to trail on ground.
8. When you want to fly, give a quick jerk.

Don't go parachuting unless you are equipped with the proper kind of breeches

How Inventions and Machines Speed Up the Work of the Red Cross in New York

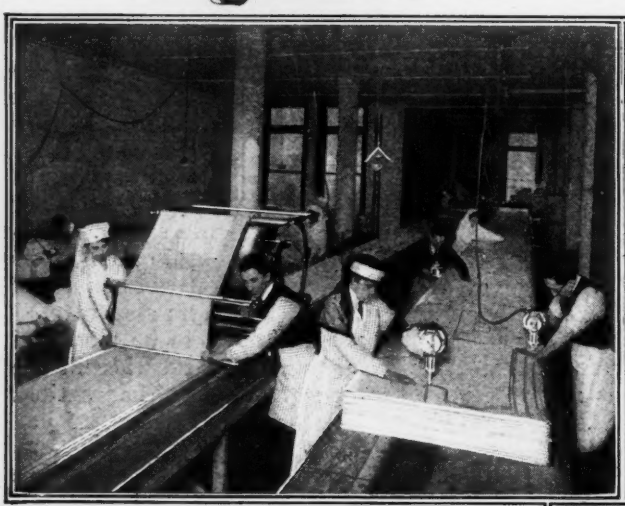
Photos by Courtesy of American Red Cross

Simplifying Sweaters

One day a man got tired watching his wife laboriously knit a sweater. "Too slow, my dear," he said; then went out and made this device. It worked so well that the gratified wife gave it to the Red Cross

A New Cutting Machine

Cutting garments for war refugees. In the Red Cross workroom where this electric cutter is used 250,000 yards of cloth are cut each month. It will cut through some 200 thicknesses of cloth at once



Making Clothes for Refugees

Another scene in the Red Cross workrooms where garments for war refugees are made. The machine on the left is spreading cloth on ninety-foot tables at the rate of 1,000 yards an hour. On the right machines are shown cutting the cloth into garments

Winding Wool on Bobbins

A device used in the Red Cross model workroom for winding a hank of wool on bobbins so it can be handled easily when used on knitting machines

A Measuring Table

A table laid out in squares. Red Cross workers can be sure of making surgical dressings according to specifications if they use this first-aid chart for correct measurements

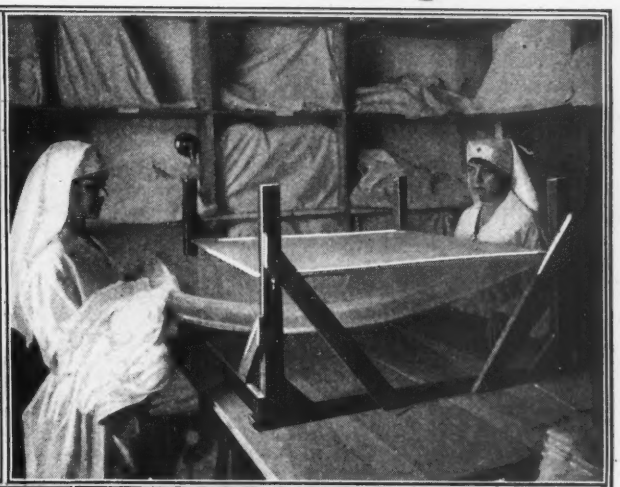
And Make Easier the Work of the Devoted Women Who Take Care of War Sufferers

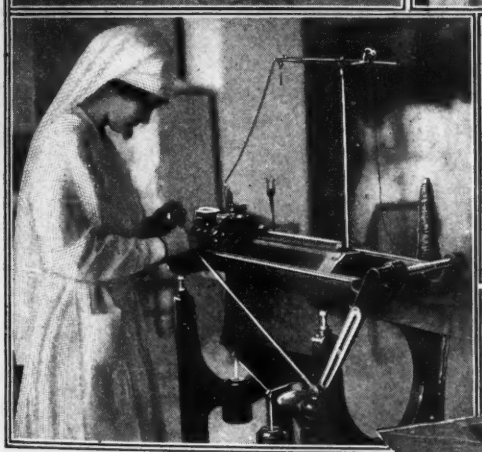
Making Patterns

An electric machine which perforates the patterns used by the Red Cross. The chalk, dusted through the perforations, makes an outline of the pattern on the cloth. Such strong material is used for the patterns that once perforated they may be used over and over again

The Swift Winder

An electric winder, known in the Red Cross workrooms as the "swift winder." It was invented by a man who wished to assist his wife in her Red Cross work. As it is started and stopped by pressure of the worker's foot on the pedal, her hands are free to guide the yarn





Unwrinkled Gauze

An ingenious device for folding gauze in required lengths. It keeps the material perfectly smooth so surgical dressings can be cut in accurate widths and lengths according to the requirements

A Dressing Frame

A frame which keeps light dressings in place. Workers can accomplish more work in less time by using this device because their material is always where wanted at the moment when quick work is imperative

A Sweater Machine

A new electric sweater-knitting machine which has found great favor in the eyes of Red Cross workers. It knits a sweater in 14 minutes

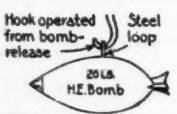
The Hawks of the Royal Flying Corps

What contact patrol means in the fierce fighting on the western front

CONTACT PATROL—"A flight of one or more planes over the lines to give General Headquarters information regarding the position of Allied and German troops and also to take offensive action against enemy troops on the ground."

The average reader who sees this definition probably concludes that contact patrol is as uninteresting as it sounds. Definitions are never as thrilling as the things they define. Any fine morning on the sector of the western front held by the British you will find back of the lines at the Royal Flying Corps' airdromes, squadrons of planes preparing for contact patrol work. The airplanes used are generally of the same type (the F.E.2.B. "Pusher"), two seaters with one hundred and twenty horsepower Beardmore engines. While not particularly fast, these planes are easy to handle. Because their work is done mostly at a low altitude, they are slow climbers. It takes them about twenty-five minutes to climb ten thousand feet, but in straightaway flight they can do about one hundred miles an hour. With the motor throttled a contact patrol machine will glide sixty miles an hour, which is possible because the plane has a nice gliding angle. The armament consists of one down-pointing Vickers machine-gun, fixed alongside the fuselage or body and operated by the pilot, and one Lewis machine-gun operated by the observer. This Lewis gun can fire up or down and also straight ahead. The motor is in the rear, so that it cannot interfere with the firing of the gun. Under the fuselage are suspended several bunches of steel arrows; also two 100-pound bombs, or ten 20-pound high-explosive bombs.

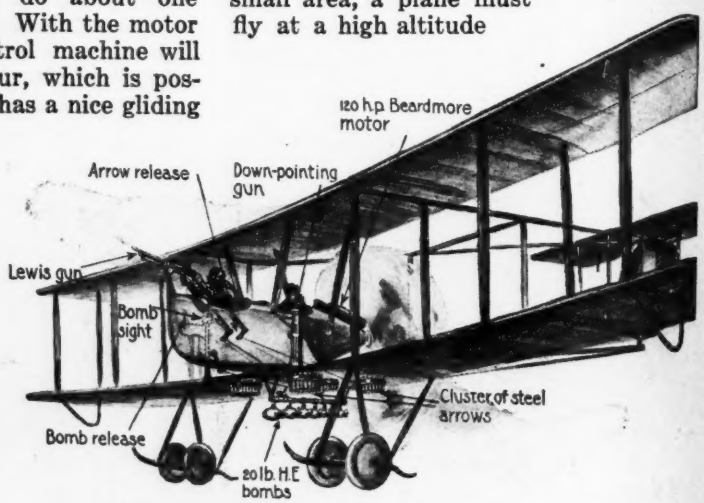
The turn of a lever releases a bomb. A slight miscalculation means a miss



This shows the hook to which the bomb is attached

They Carry Bombs, Armor and Machine-Guns

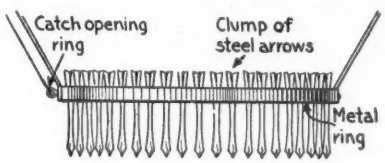
All these missiles of death are released from the observer's cockpit by a bomb-firing trigger attached to a bomb-sight. This bomb-sight is not used on contact patrol, as the airplane has to spend considerable time over an objective before it can be used. At a given height there is only one point of space where the airplane must be, if the bomb is to hit its objective. A miscalculation, no matter how slight, means a miss. When this happens, the aviator must turn his plane around and try once more to make the imaginary path of his machine pass exactly through the proper point. These repeated tricks are made for half an hour. The aviator must maneuver at will, unhampered by other planes. It is obvious that when the bomb-sight is used over a small area, a plane must fly at a high altitude

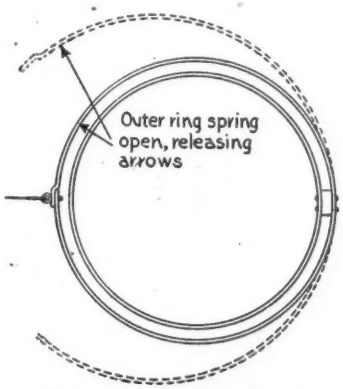


A "contact airplane" armed for its arduous duties, with machine-guns, steel arrows, and twenty-pound bombs

and alone. On contact patrol, planes fly very low and have done such effective work particularly with their machine-gun fire, that the Germans have found it necessary to dig bullet-proof trenches alongside the roads on which their troops march. At the alarm, the regiments dive for these trenches where they are comparatively safe.

Generally five planes are assigned to a contact patrol squadron. They fly in the usual V-shape formation. Once over the lines, their work commences. They remind one of hawks hovering over a chicken yard. Eagerly the pilots and observers scan the ground below, undaunted by the hail of lead poured up at them from machine-guns and "Archies."





These arrows, dropping from a great height, have considerable penetrative force, but a steel helmet affords protection

What's That? A Regiment of Germans?

What the observers in the machine want to see most is a train or railroad or road-bridge. As soon as they see one, down they swoop. One after the other lets go a load of bombs and climbs again. The observers note the damage, etc. Suppose they see a regiment marching rapidly towards the front. In a fast glide, they descend almost on top of the startled soldiers. The machine-guns mow the Germans down, and often one plane of the squadron, flying higher than the rest, releases several clumps of the steel arrows. If there are no safety trenches at the side of the road, it is possible that almost the whole regiment may be wiped out. Should there be trenches, no doubt machine-guns will be hidden in them with the result that perhaps one or more planes of the squadron will be brought down by their fire. Hostile ammunition and gasoline depots, headquarters, railway junctions, detraining stations and aircraft hangars are all objectives for the pilots of a contact patrol squadron. It may be that there is a detachment of enemy engineers busily engaged in preparing the site for a new battery or building a bridge. If seen, rest assured that the planes will give them a warm reception.

The saw, from 150 to 300 feet long, cuts the weeds; a wooden grating collects them and a rake removes them

Submarine Saws for Water Weeds

A SUBMARINE saw is used to clear weeds from irrigation canals on the project of the United States Reclamation Service at Orland, California. It is five-sixteenths of an inch wide, one-fiftieth inch thick, and the teeth are spaced seven-sixteenths of an inch apart. It is made of special steel in flat, flexible, tape form and has toothed edges. Two men, one at each end, operate the saw by means of ropes, starting at the lower end of the section to be cleared and working up-stream. The saw is placed diagonally across the stream, one man keeping slightly ahead of the other. It is held at the bottom of the canal by iron weights placed at intervals of about three feet. To remove the weeds, planks are placed across the banks, about six inches above the surface. Slanting wooden pieces project into the water forming a grating which catches the mown weeds.

Plowing with Coal-Gas on English Farms

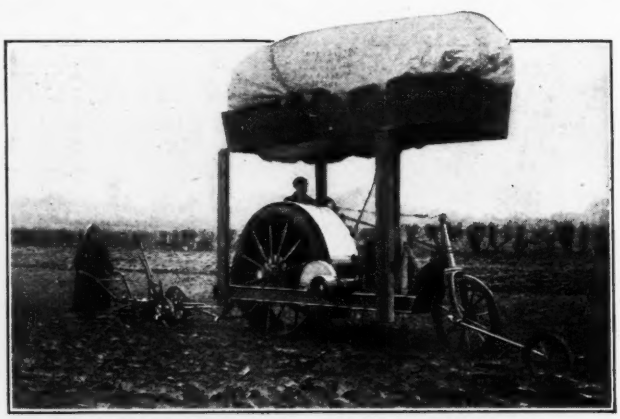
The scarcity of gasoline combined with its high cost compels this wartime measure in Great Britain

Soldiers operating a coal-gas-driven tractor and plow on an English farm

THE war is compelling the substitution of coal-gas for gasoline as a means of motive power for automobiles in England. Tractors carrying balloon-like containers in which to store the gas are not uncommon sights in the fields, soldiers being brought from the front to operate the machines.

But the employment of coal-gas is only a wartime expedient brought about by the scarcity of gasoline and its high cost. With the resumption of normal conditions after the war it is expected that gasoline will again come into general use in Great Britain.

The British Government decided in 1916 to restrict the use of gasoline, following the great demands made on the petrol supply of the country for war purposes. Then the question of obtaining an efficient substitute for gasoline came up. When coal-gas was being considered the difficulty of storing it had to be overcome. In early experiments gas compressed in steel cylinders was employed, but there was trouble in reducing the pressure; hence the idea of a flexible bag to be carried on top of the vehicle was evolved. This bag was globular in shape and roped down. It was supplied with gas through a flexible sleeve, the connection to the engine being made by a tube with a control-flap within reach of the driver. This method of storage has had considerable popularity.



Showing the tractor plow, with power furnished by coal-gas, plowing furrows in the soil of England

A fresh supply of coal-gas being brought into the field on an English estate to operate a tractor plow

However, the bag, like the gas it contains, can be accepted only as a measure necessitated by the war, since it does away with metal cylinders. These are not practicable because of the great demand for metal.

A Tunnel Is Coming. On with the Fresh-Air Mask

LOCOMOTIVE engineers of trains which pass through long tunnels or snow sheds often suffer from lack of pure air. The smoke and the exhaust gases pollute the stagnant air in the tunnel and make it almost suffocating. To remedy this condition an engineer of the Southern Pacific Company invented a device which is shown in the accompanying illustration. A funnel fitting over the nose and mouth of the engineer is connected by means of a rubber tube with an air-pipe which runs to the main air reservoir of the air brake system. A small cut-out cock in the pipe permits proper regulation of the supply of air.

The engineer in this picture regales himself with pure air while his train runs through a snow shed

Fold Up the Propeller When You Want to Row

NAVIGATING small motor boats in the waters of Hudson Bay and the contributory rivers is not easy. Shoals mean frequent portaging. The situation has stimulated a Canadian inventor to bring out a small engine for rowboats, the propeller of which can be lifted up into the boat by the twisting of a handle.

In shoal water the propeller and shaft can be lifted out of harm's way into a water-proof metal jacket

The propeller is not situated aft, but amidships. The shaft protrudes through an encased slot in the bottom. The casing of the slot is proportioned so that, when the propeller is not needed, or when it drags bottom in shallow water, both propeller and exposed shaft can be lifted up out of the way of rocks and sand. The casing which is built along the center of the floor is water-tight. The toggle-jointed shaft from the engine enters it at the forward end through a water-tight journal.

The propeller and shaft are ingeniously brought inboard by a lever, the handle of which is situated conveniently on the outside of the metal casing. The handle works a pivot which communicates with the inner side of the casing.

This Isn't the Only War Which Has Caused Prices to Soar

IN these days of tribulation, when everything rises but father's wages, we all very consistently bemoan the high cost of living. But this is not the first and only time that prices have been high. During the Civil War wages ran from $1.12 a day for laborers, to $2 a day for skilled workmen. This, however, did not prevent a shave from costing ten cents, or a haircut twenty cents. Hotel rates were $1.50 to $2 a day, and ice, which was considered a great luxury, was supplied at fifty cents a week for ten pounds daily. Strangely enough sugar was the chief bone of contention in those days, too, and it cost twelve to fifteen cents a pound.

This "zigzag platform" facilitates the loading and unloading of vehicles, making it possible to load and unload from sides and ends simultaneously, besides occupying far less space

A Compact Zigzag Platform for Loading Wagons

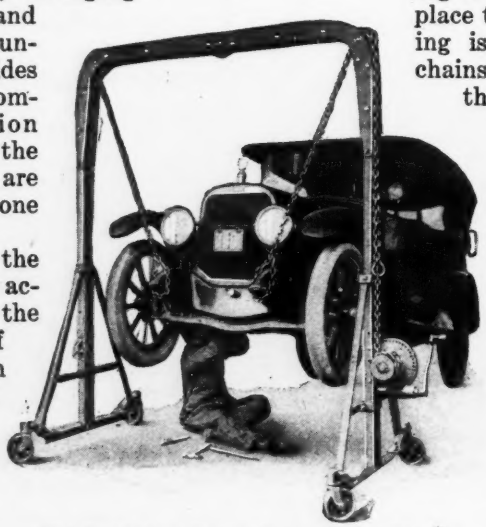
LET us introduce you to the zigzag-edge platform. Although its name suggests associations of Coney Island, it is a misnomer, for this platform was designed for use in staid mercantile pursuits. It will be employed, in fact, to facilitate the loading and unloading of vehicles.

An excellent idea of the platform can be gained from the statement that its loading and unloading edge has a "sawtooth" formation, the spaces between the "teeth" being large enough to back in vehicles. The "teeth," or zigzag edges, allow wagons and automobiles to be unloaded from their sides and ends, as the accompanying illustration shows. The sides of the notches, of course, are at right angles to one another.

In addition to the advantage of easy access to and from the sides or the backs of vehicles, the platform decreases the extent of projection into the roadway of wagons, and apportions a definite amount of space to each.

Getting Under Your Automobile by Hoisting It Up

NOT only makers and repairers but also private owners of automobiles will be interested in the hoisting frame for automobiles invented by J. A. Weaver of Springfield, Illinois. The accompanying illustration clearly shows the simple construction of the device. It consists of a rectangular steel frame, strongly reinforced and resting upon braced bases placed at right angles to the plane of the frame. Ball-bearing casters under the bases make it possible to move the hoisting frame easily from one place to another. The hoisting is done by one or two chains running either over the pulley in the middle of the top of the frame or over pulleys placed in the corners. The chains are wound by a hoisting mechanism operated by a worm drive.

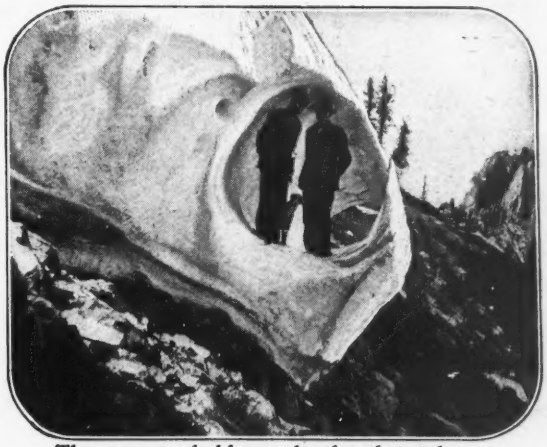


This hoisting frame does away with the objectionable cleaning-pits in garages

The device is strong enough to hoist with perfect safety any make of pleasure automobiles. One great advantage of this device is that it requires little space.

Signaling System Is Employed in American Barrage

SOME details of how the American troops in France lay down a barrage before an attack is made by infantry are related by Major-General Charles M. Clement, U. S. A., who has returned from an inspection trip to the front. A somewhat elaborate system of signaling is employed in connection with the barrage. This system is changed daily in order to frustrate the efforts of spies. The width of the barrage varies, and the fire is made intensive or light, depending on whether the men move backward or forward.

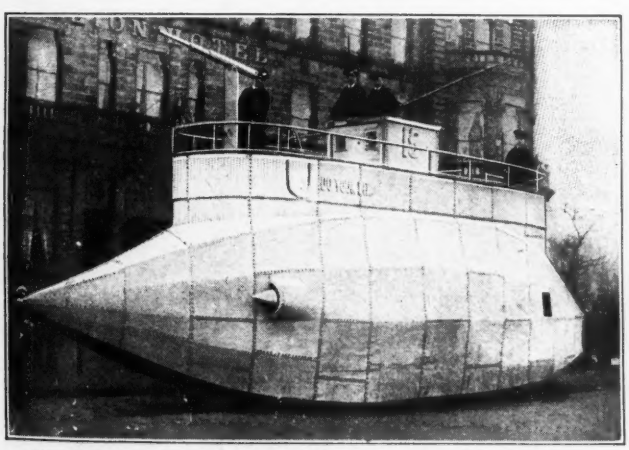


The cave probably marks the place where a boulder dropped out of the surrounding snow

This Submarine Raises Money Instead of Killing

THIS is the story of a submarine that invaded Scarborough, England, penetrating the very heart of the city without causing the loss of a single life. Furthermore, it was the means of helping to raise $500,000.

It was at first planned to have an undersea craft anchor in the harbor in order to spur persons to give to the fund. This idea being found impractical, a street-car submarine bank was built. The actual work consisted in transforming the vehicle into a submarine on wheels. The members of the crew shown in the accompanying illustration are Scarborough "sea scouts," each of whom has been on vessels torpedoed by German submarines.



This submarine took money instead of lives when it invaded Scarborough, England, to aid in raising $500,000

Nature Carves a Queer Snow-Cave in the California Sierras

THE accompanying picture is a June snow-scene in the high sierras of California. During the progress of a government survey the engineers found the peculiar cave formation in the end of a bank of snow which was rapidly melting away under the rays of the sun. It is not known how the cave was formed, but it is believed that it contained a big boulder which, when it became warmer, dropped out of the crust of snow enclosing it and rolled down the mountain side.

Forts Built by Vauban Are All That Remain of Ypres

THE only things left standing in Ypres after the German attacks are the forts built by Vauban early in the seventeenth century. This was one of the comments made by Major-General Charles M. Clement, U. S. A., regarding conditions that attracted his attention on the firing line in France. He relates that in these damp forts two British commanders lived during months of warfare. It is queer that a seventeenth-century fort should survive a twentieth-century bombardment.

Teaching Machine-Gunners to Fire at Art

How paintings worth thousands, the work of famous artists, are used to develop skill in gunnery

By John Walker Harrington

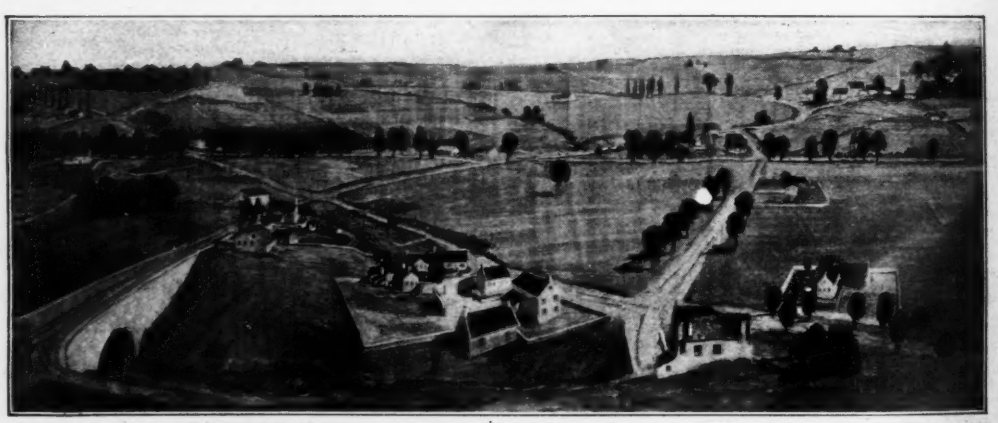
EVERY war has called in artists to help the fighters. Michelangelo, Leonardo da Vinci and Benvenuto Cellini did their bit in their time, and now come the Academicians of our own day, whose ambition it is to paint landscapes at which soldiers will be glad to aim either cannon or machine guns. These scenic targets are works of art in every sense, for they must come from the skilled hands of masters of perspective and atmosphere and must be so ably composed that they serve just as well as long reaches of hill and dale and rolling uplands. The Art War Relief, an organization which has been enlisting noted painters for this all-important work, announced that the canvases of students and amateurs were not available.

Artificial Landscape Targets

Most young men are city or town bred. Hence few of the soldiers of our national army have a clear idea of distances in nature. As many of the cantonments have not been placed amid scenery like that which marksmen are likely to see "somewhere in France" or "on the way to Berlin," artificial landscapes are provided on which they can practice. The paintings are too valuable for cannon fodder or even for machine-gun feed, but they serve wonderfully well in giving the illusion of panorama. The series which have been painted by H. Bolton and Francis C. Jones, both veteran members of the National Academy of Design, are typical of the kind of art which is now in league with war. Some of these pictures were used by machine-gun companies at Camp Upton near Yaphank, L. I., before their departure for overseas.

Distance and Proportion

As the machine-gunners "lay on" their pieces in front of this pleasing mark they must keep in mind two things—range and close designation. The middle distance in the painting carries the normal vision back about 2,500 yards. The mountains far in the background are supposedly eight miles away and therefore out of range. The canvas is covered with houses and churches, bridges and culverts, and even a winding stream. The gunners aim their weapons at these various objects. The commander comes up behind them and points out errors they have made in sighting due in part to their un-



The aims of war are to aim so as to score. A faithful reproduction of a landscape gives the gunner a sense of distance and proportion not otherwise easily acquired

Machine-gunners learn from artistic reproductions of the terrain how to judge of distance and of the interrelation of objects. Art with a capital *A* helps them to become experts

trained eyes and in part to their lack of familiarity with the mechanism.

How many men are there who grasp a description and act at once upon it? The officer gives the command, "Lay on black rock left clump of trees—three fingers!" Instantly the sergeant must repeat this order and see to it that the smooth barrel is so adjusted that it will guide bullets in the direction named. The quick understanding of the description of objects in a landscape can be developed by the use of the imitation terrain of paint. The firing of machine guns effectively is quick, sharp work and all the training of eye and brain which can be imparted stands the soldier in good stead in an emergency.

So exact are these high-art targets, owing to the co-operation of the military authorities and the designers, that even the complicated problems of strategy can be solved quickly by their use.

Grain Field a "Nest of Death"

After the marksmen have become more experienced they are assigned to devising ways for routing snipers out of hidden retreats supposed to be in all these mimic landscapes. The purpose is always to kill as many of the enemy as possible with the smallest amount of ammunition. Assume that there is in the center of one of the painted transcripts of nature a waving grain field, all golden in the sun, and enveloped in a mellow haze, as an art critic might see it. The machine-gun captain considers it as a yellow nest of death in the midst of which are certain big and deadly wasps, the stings of which are laying low comrades of another command. He cannot see exactly where the buzzing pests are straddled, but no time is to be lost. He gives the command to "traverse the field," which means that his gunners so divide the whole expanse of nodding stalks among them, that the zones reached by the rain of bullets account for every square foot of the suspected area. The variation of fire is made by causing the individual gunners to tap their pieces gently, so that a difference of two inches at the end of a barrel becomes a large space with the widening angle reached in a distance of a mile or so. The method of tapping can be learned readily in front of one of the brush creations and a man who is quick of eye and hand may soon become very proficient.

Useful in Estimating Trajectories

The counterfeit countrysides serve just as well as the real ones in estimating trajectories of projectiles intended for a certain locality and in the mastering of much of the theory of gunnery practice. The mistakes of the tyro can be constantly corrected. As the canvases are becoming more and more exact in their proportions, they are considered already as among the indispensables. A British officer on seeing some of these examples of American skill at Camp Upton recently, remarked that if the Allies had had as good ones they would have been able to have killed more Germans.

Using his derby hat in lieu of a tripod in order to get a coveted photograph

A Derby Hat Used in Place of Camera Tripod

A PHOTOGRAPHER desiring to make photographic copies of certain paintings in the Corcoran Art Gallery, wrote to the superintendent of the institution and received the necessary permission, but upon arriving at the gallery he found that they did not permit tripods to be erected upon the marble floors.

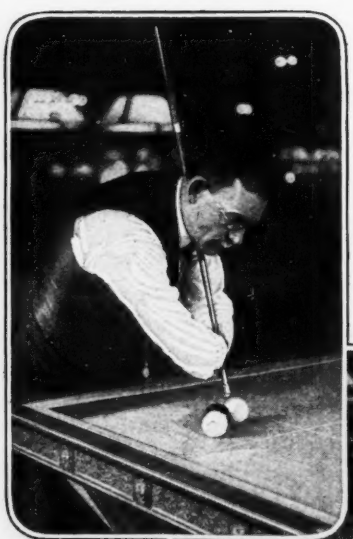
Not to be outdone, he used his derby hat, which, inverted and crushed in a little, balanced very nicely on the large mahogany rails in front of the pictures. Upon this he balanced his camera and, with a little care in focusing, using the rising front to give the proper perspective, managed to get the long-time exposures required by the soft lighting. The scheme worked perfectly and the copies desired were obtained. This method may be used for exteriors as well; but the photographer should be close at hand to look out for his camera in case it should overbalance.

Handless—And Yet He Is a Champion Billiard-Player

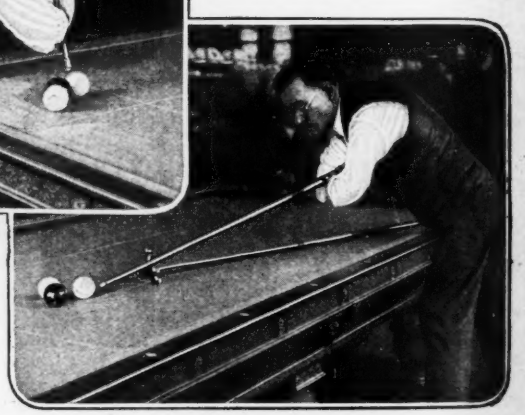
GEORGE H. SUTTON, the veteran billiard-player, has demonstrated to the world that a man may become an excellent billiard-player without hands. Sutton lost both hands when a boy by coming in contact with a circular saw. This did not prevent him, however, from taking up billiards, first as an amusement and later, when he had acquired remarkable skill in the manipulation of the balls, to enter the class of professional "short-stops." In a match game during the past season he made a high run of 113 in 18.2 balkline billiards.

Sutton uses no attachment to hold his cue. By patient practice he has acquired such marvelous skill in the use of the flexible muscles on the stumps of his arms, that they supply him with a good substitute of the "wrist-movement" so essential to good playing.

Many armless men and women have learned by painstaking practice to make use of their feet for writing, piano-playing, etc., but there are probably no parallel instances on record where a man deprived of both arms has become an expert billard-player by the use of his arm stumps.



A seemingly impossible feat—making a massé shot, holding the cue between his arm stumps



Handless billiard-player George H. Sutton making a carom shot with bridge

Photos © Int. Film Serv.

He Outswims the Ducks in His New Diving Dress

ON a recent gray Saturday afternoon, in London, the fussy little tugs and launches were puffing about their business on the Thames, and every now and then a lumbering Thames barge would pursue its unbeautiful bullying way down the river. The whistles were hooting, and a few gulls wheeled about, picking up scraps from the oily water—in short, it was just a regular, misty, gray London afternoon. Suddenly, though, there was a shouting and a craning of necks, and the sleepy river life became immediately wide awake. A man had jumped into the river from one of the boats. Was it an attempted suicide? Had he gone over to rescue some one? The black, murky waters swallowed him up. He bobs up. The river men could hardly believe their eyes. He had reappeared with a two-bladed paddle, and was propelling himself along! It all proved to be a demonstration of the new Davidson life-saving suit.

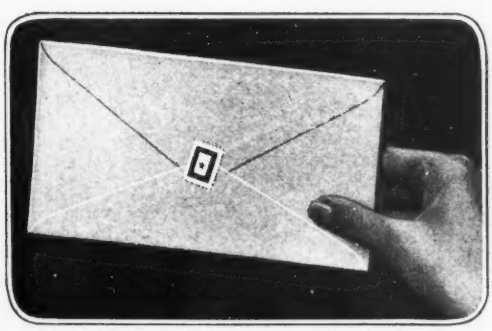
Properly inflated—but not with self-conceit—you can paddle yourself along comfortably in this union suit. All you have to do is to inhale as much air as possible, then exhale it through the tube into the costume. In other words buoy yourself up with your own hot air

This shows a man properly equipped for a trip that is apt to lead him into a temporary sojourn in the water. The suit is air-tight, and if he has enough breath left to inflate himself he can keep afloat for a long while

This costume is made on the same principle as a diving-suit. It is both air-inflated and waterproof. Air-chambers are provided in the body portion and in the leg portions, and these may be blown up by the mouth, through suitable tubes. The dress can be inflated in forty seconds. A belt around the middle, together with adjusting the amount of air in the various chambers, serves to regulate the equilibrium.

The Service Stamp is the Latest Patriotic Device

IN these days of rapid introduction of various kinds of new stamps it is not surprising to hear of the service stamp. These stamps are made in sheets of one hundred with one, two or three stars, as circumstances require, and are designed for use in the same way as the Red Cross seals. The cost of a sheet of one hundred stamps is negligible.



The service stamp to be affixed to your letter to inspire your friends with your own sense of duty to flag and country

Affix one of these stamps to your letter, and thereby give your friend a hint that you have endeavored to fulfil your duty to your country; it is bound to be a reminder to him if in any small particular he has been remiss in that measure of duty which we owe our country.

Chinese women cleaning the cab windows of a Southern Pacific Railroad locomotive in Oakland, California

Chinese Women Working on Railroads in California

IT is well known throughout the country that the people of the Pacific coast states take anything but kindly to Oriental labor. But at the present time there is such a serious shortage of white labor throughout the United States that even our Western brethren have had to down their prejudices and accept the inevitable. The Chinese coolie has long been a factor in the labor market of the West, but as a rule his consort has held aloof from manual labor. Now, however, a change has been wrought.

Nothing could better indicate how serious is the shortage of white labor in that part of the country than the fact that Chinese women are now employed by some of the railroads on the western coast.

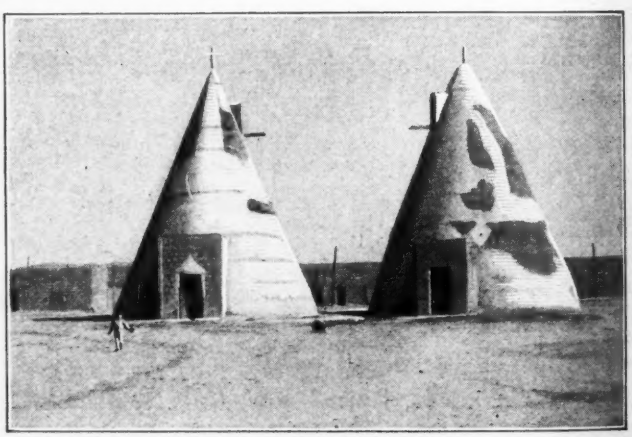
An Alibi for the Bee in the Orchard

THAT bees injure fruit is a common belief in some quarters, but investigations recently carried out in Italy prove it to be without foundation. Bees cannot perforate the skin of fruit, and the damage attributed to them is really due to birds, wind, hail, hornets, wasps, and certain other insects. Bees are, in fact, of much benefit to the orchardist, because they effect the cross-pollination of fruit trees.

Mexican Corn Bins Look Like Old-Fashioned Sugar Loaves

AT first sight the objects that form the subject of our illustration look as though they were the twin spires of a sunken church. As a matter of fact they are corn bins on the Hacienda St. George, in Coahuila, Mexico. They are constructed of adobe or sun-dried bricks, and are plastered on the outside. On the plaster landscapes are painted in bright colors. One of the bins, it will be noted, is surmounted by a cross.

The corn is introduced through the little doors in the apex of the cones, and is taken out as required through the regular door.

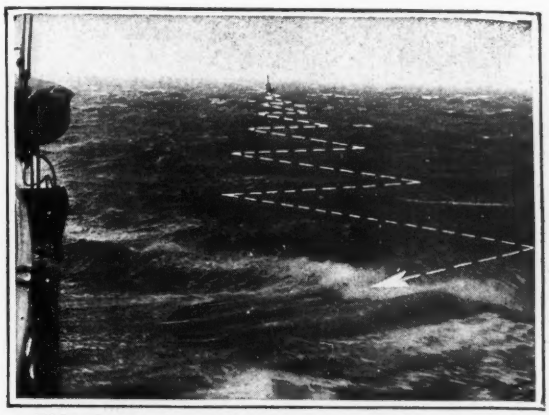


Corn bins on a Mexican hacienda, shaped like sugar loaves, but made of adobe or brick, and brightly decorated

Wouldn't This Puzzle the Enemy?

A mine or torpedo that zig-zags under water to find its prey

A MINE which travels under water in a zig-zag fashion, somewhat like a drunken man on the sidewalk, and which therefore makes a terrible nuisance of itself, has been invented by a foreign officer, a noted authority on mines and explosives who is co-operating with the U. S. Government. The mine consists of two parts fastened together, but separated by a wall. One of the chambers, that in front, contains the explosive charge and has at its forward end the contact trigger which explodes the charge when it hits the object for which it is intended. The other compartment contains the motor and a mechanism which alternately drives first one then the other of the two propellers, thereby giving to the mine a zig-zag course, but tending in the general direction of the objective point, while crossing and recrossing the medial line at oblique angles. It is the theory of the inventor that by this zig-zag motion the chances of the mine's hitting the objective are greatly increased. A weighted keel maintains the mine in the desired depth under the surface and also prevents its rolling. As it may sometimes be desirable to drive the mine at a different depth, the keel is removable and may be supplanted by a heavier or lighter keel or fin, as the case may require.

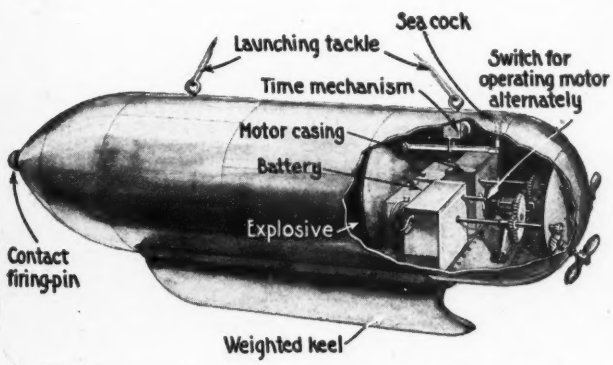


This picture shows the zig-zag path which the new submarine mine follows in its under-water course

Any kind of explosive may be used in this mine, but the inventor favors T. N. T., wet gun-cotton or dynamite, and also advocates the additional use of mono-nitro-naphthalene which, when the mine is exploded, gives off a dense black smoke, which will envelop the vessel struck and prevent signaling, repairs or rescue.

As the presence of such a mine in the water constitutes a constant danger to shipping, provision is made to cause it to sink after a predetermined period. A timing mechanism opens a valve in the rear end of the mine, allowing the water to enter. The weight of the water causes the unexploded mine to sink to the bottom, preventing accidental discharge.

To propel the mine, each propeller may have its own motor, and the motors work alternately, or there may be but a single motor, the power of which is applied alternately to the propellers by an oscillating gear or otherwise. The invention permits of many non-essential variations.



The front part of the mine contains the explosive; the rear part the propelling mechanism and control

Worse Than the Shinplasters of Civil War Fame

A CURIOUS condition of affairs with respect to money prevails in the department of Nariño, the southernmost department of Colombia. This region is isolated by poor means of communication from the central government and has regulated its own affairs to a great extent. When the rest of the country adopted a gold standard Nariño refused to conform and enforced a local silver standard. As it accepts at silver value coins of all nations and dates it has become a dumping - ground for coins no longer current elsewhere.

He is not a millionaire's son. All this Colombian paper money is worth just one dollar. A paper peso is worth one cent

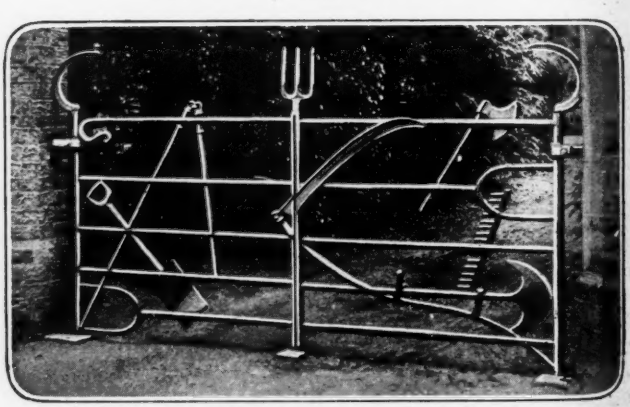
It is said that the most abundant coins are the old eight-real pieces of the early years of independence. A few years ago, we may add, the whole of Colombia was swamped with paper currency enormously depreciated. At one time it took 22,500 pesos of this paper to buy a United States gold dollar. The government has now issued a decree recalling the national silver coined before 1911 and all foreign money now in circulation.

Moon and Earth Help French to Aim Cannon

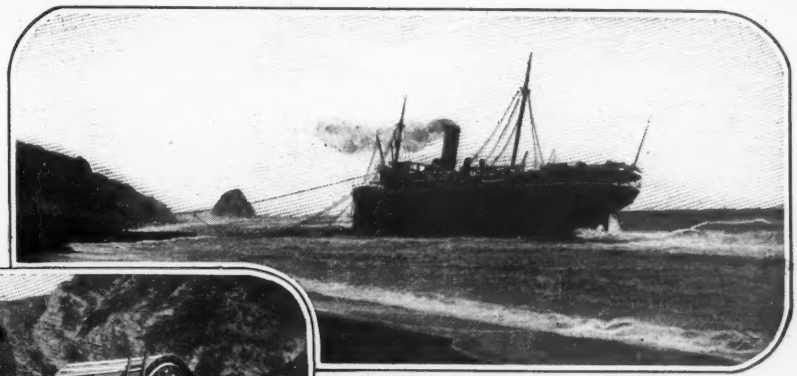
THE French engineers in the European war have reached a high degree of perfection in mathematics, according to Major-General Charles M. Clement, U. S. A., who made an exhaustive study of conditions on the firing line. These sappers of the French army have figured out the influence of the earth on a shell traveling out of a cannon, how much farther it will shoot north than south, and to what extent the moon will deflect the shot. As a result, what is described as the ultimate error of the cannon shot is being rapidly overcome. Moreover, if a commander is unable to point a cannon within ten feet of the target, he is not regarded as a success.

This Is a Farm Gate, No Doubt

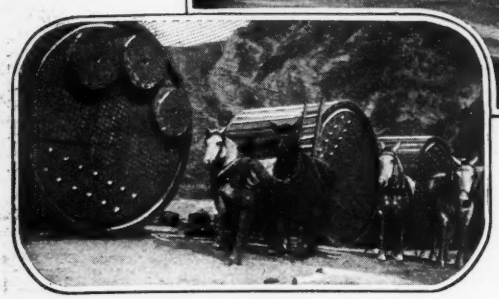
PERHAPS it was his passionate love for farming, perhaps a dawning sense of art, or pride in the paternal acres which had come down to him through many generations of tillers of the soil, that induced the owner of a farm in Moulton, Northampton, England, to put the quaint gate shown in the accompanying picture at the entrance to the driveway leading to his farmhouse. Anyone who passes that gate will know that the owner of the estate is a farmer and so proud of it that he wants everybody to know it. The ornamentation is, to express it mildly, original in design and of striking appearance, but does not betray a high degree of artistic taste. However, it is symbolic of the farmer's calling, and who shall criticize?



An English farmer has decorated his gate with the various implements of his calling. If not artistic it is surely symbolic



The boilers contained enough air to keep them afloat while they were towed ashore. They were then encased in planks and started for China for duty in another ship



The ship could not be saved, but cargo, boilers, and machinery were taken out

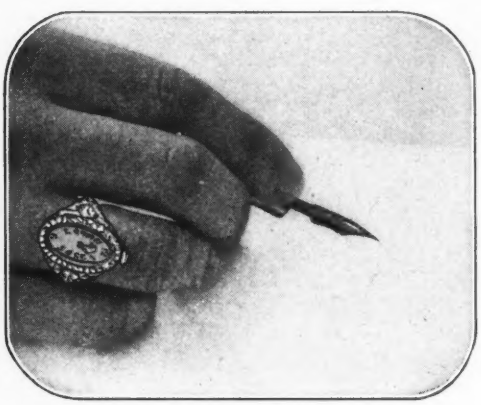
How the Boilers of the "Bear" Were Salved

THE steamship *Bear* of the American Geodetic Survey stranded near Cape Mendocino, on the California coast. When it was found impossible to save the ship all efforts were confined to the salvage of the valuable contents, including the boilers and machinery. The machinery was taken apart and conveyed to the beach piecemeal. The large boilers, however, six in number, could not be taken to pieces, and their salvage was therefore attended with great difficulty. Each one of the boilers was eleven feet six inches long, thirteen feet six inches in diameter and weighed fifty-one tons. Each individual water tube was first plugged at each end to make it airtight. The air enclosed in the pipes and in the boiler was sufficient to keep the boilers afloat after they had been lifted out of the hold by a derrick and deposited in the water. The boilers were rolled on the beach, encased in an armor of planks, then set afloat again and towed twenty-five miles to Eureka, California, whence they were shipped to Shanghai to be placed in another hull.

A Lilliputian Rival of the Popular Wrist Watch

IF the ponderous old grandfather's clock, with its weights and wheels, could do so, it would doubtless raise its hands in surprise at sight of the ring watch, the smallest member of the time-keeping family. This tiny record-keeper of the minutes and hours adorns, and is adorned by, a finger-ring studded with jewels. It is shown in the accompanying illustration.

This watch is a composite timepiece, the works being of Swiss manufacture, and the case of New York make. The movement is smaller than a ten-cent piece and the case is studded with diamonds, even the winder being set with one of these precious stones. As a novel and attractive ornament this little watch is pretty sure to find favor with the fair sex, and it is possible that it may to some extent replace the wrist watch which has recently gained so greatly in popularity, especially among soldiers.

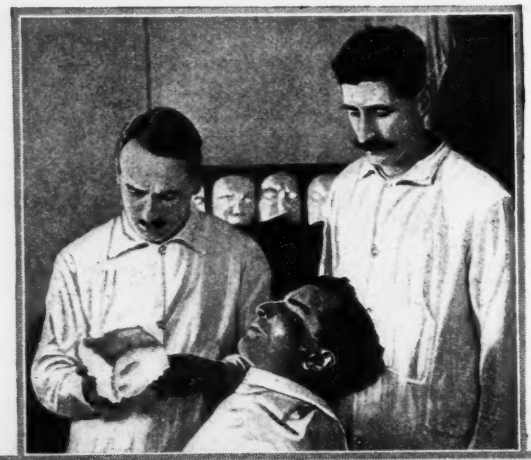


This little watch on milady's finger ring is a real, honest-to-goodness timekeeper

First Heal the Wounds, then Hide the Scars by

The First Step

Captain Derwent Wood, an English sculptor, has worked out a method of covering disfiguring scars by metal masks painted in life-like colors. The method is not new, but has been greatly improved by the sculptor. The first step toward restoring the patient's features consists in making a plaster cast of the parts to be covered by the mask. This is a great boon to the disfigured fighter, although he may well be proud of his scars



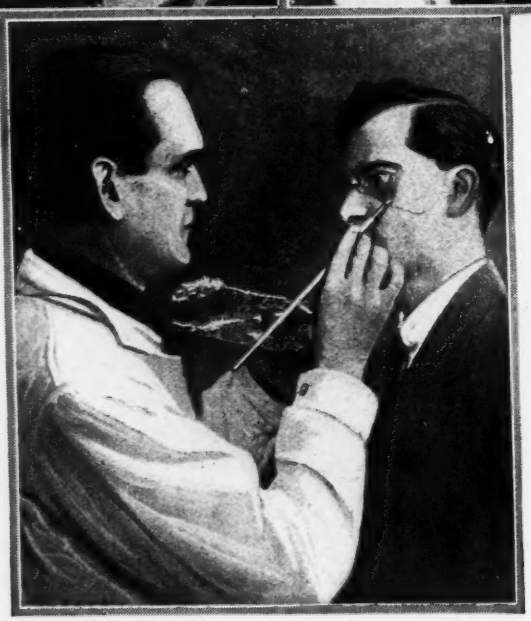
Almost Finished

The thin metal mask, having been carefully fitted and trimmed to the proper size and shape, is enameled and painted to match the color of the patient's skin. The picture shows Captain Wood with the almost finished mask in his hand, about to adjust it to the features of the patient before him. The means for fastening the mask are still lacking

Photos © Underwood and Underwood

The Rough Cast

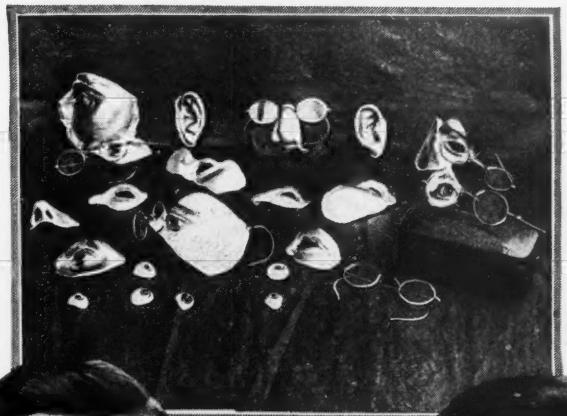
The masks are made by an electrolytic deposit of pure copper upon a cast of the features as they are intended to appear. They may also be made of silver or of some alloy of silver and copper. In the picture Captain Wood is examining the roughly molded mask before it is trimmed, adjusted and finished by enameling and painting. Great skill is required in order to match perfectly the lineaments and complexion of the uninjured side of the face



The Finishing Touch

After all the preliminary work is done and the mask fully completed and provided with the means of fastening it, the patient puts it on and the sculptor, who is also a painter, puts the finishing touches to his handiwork. One of the most difficult problems is to obliterate the tell-tale border line where the mask and the skin meet. This is done by careful retouching of the painted surface. The manner of holding the mask in place depends upon the conditions in each individual case. In this case it is held in place by a pair of spectacles

Covering Them with Artistically Shaped Masks



A Shell's Work

Although the work of Captain Wood is by no means confined to war injuries, the majority of his patients are men who were disfigured by more or less serious injuries received in the war. The picture below shows a young British soldier who was hit between the eyes by a shell splinter. See the transformation wrought by the mask, in the picture to the right

Only Imitations

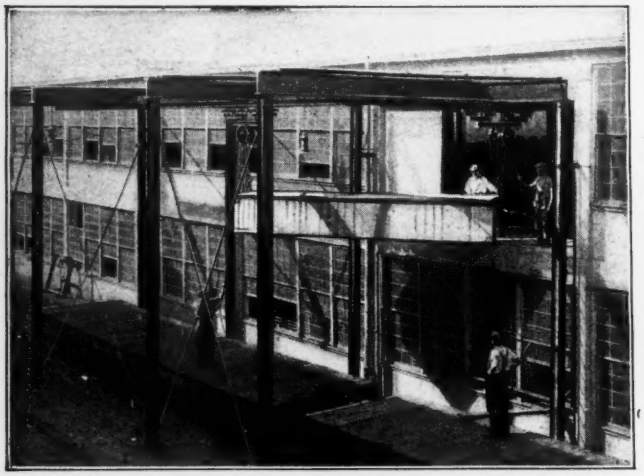
The stock-in-trade of this human repair shop is of a varied nature. Masks in every stage of completion, ears, eyes, noses, chins or other parts of the features are the most common specimens in evidence. Spectacles are often employed as a convenient means of unobtrusively fastening the metal masks so as to cover the disfiguring scar caused by injury or disease

A Sculptor's Idea

The officer shown standing in the picture, palette in hand, is Captain Francis Derwent Wood, the English sculptor, who enlisted in the British army in May, 1915. He entered the hospital service and soon was placed in charge of the splint room of one of the military hospitals in London. His experience there suggested to him the thought that art could be of great help in extending and perfecting the efforts of plastic surgery. The government encouraged him and he was given an opportunity to develop his method

With the Mask

The picture above shows the British soldier of the picture on the left, as he appeared wearing the mask made for him by Captain Wood. It is held in place by the spectacle frame and completely hides the terribly disfiguring scar which the shell-splinter wound left between the young man's eyes. It is so perfectly made that it is almost impossible to see where the mask ends and the natural tissue begins



The lifting tackle travels on a track extended from loading room across track. One tackle performs the operation

Wafting Five Tons About as Though They Were Thistledown

"ALL ready below there?"

"Yep, let 'er come."

There is a whirr and the rattle of a running chain, and a huge packing-case floats airily out of a second-story window and smoothly descends towards the flat-car which is waiting below to receive it. "Easy now—bit further—whoa!—back a bit—*a-a-all* right."

That is about the sum total of the operation of loading a packing-case containing five tons of motor-truck onto the cars for shipment, at the plant of one of the big truck manufacturers in Michigan.

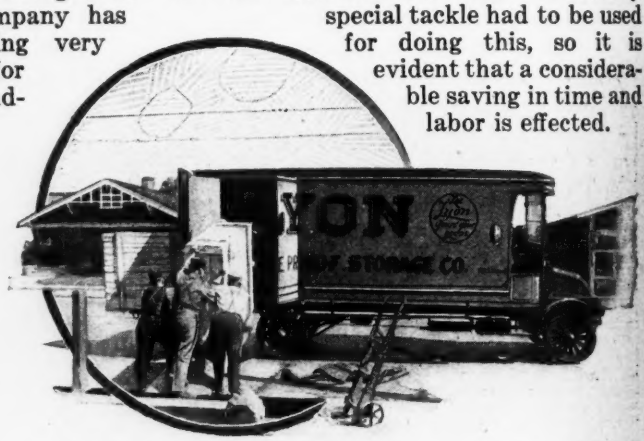
The reason for the ease with which the thing is done is due solely to an ingenious bundle-carrier that the company has installed. There is nothing very new in its essential parts, for it is the regular chain-and-pulley type of purchase, but the application to special conditions is very interesting. The track on which the lifting tackle travels is extended across the track and into the loading room too. Consequently the cases are moved around, swung out, lowered, and everything is done with the same tackle. Four boxes are loaded onto one car.

Formerly it took ten men a whole ten-hour day to do a single job, and inclined planes had to be built to load the upper boxes from, using rollers and crowbars. Now four men can load about forty-eight boxes a day, and, if necessary, one man does it.

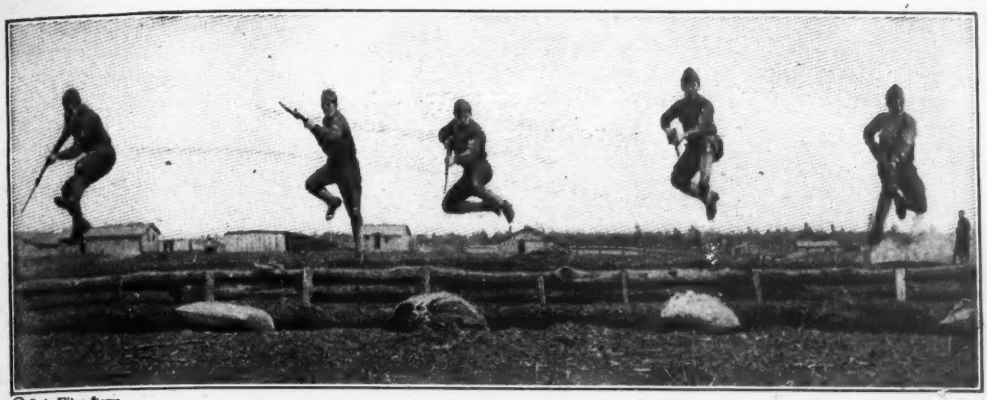
This Moving Van Loads From the Side

HOUSEHOLD goods and pianos, as well as other things that had to be moved for some considerable distance, formerly went by railroad. Recent railroad congestion, however, and the difficulty of getting box-cars for anything that does not come under the head of war necessities, has brought home to many people the fact that it is often cheaper and handier to have their household furniture moved by vans. Even if it did cost a little more, there is a great deal gained in convenience, because the goods are actually taken right out of your own dwelling into the same van that conveys it to your new abode. But as a matter of fact, it is actually cheaper in many cases than to pay freight plus cartage.

As an aid to dispatch, a Los Angeles, California, moving man has equipped his truck-van bodies with side-moving doors that make it possible to load heavy pieces of furniture, such as pianos, right onto the van from the sidewalk. Formerly special tackle had to be used for doing this, so it is evident that a considerable saving in time and labor is effected.



Showing a side-opening arrangement whereby heavy goods can be loaded without aid of special tackle



© Int. Film Serv.

Uncle Sam's embryo soldiers obey the call to go "over the top" with all the will in the world — fit for a fight or a frolic as fate may dictate when they get "there"

Going "Over the Top" with the Soldiers at Camp Upton

THE accompanying photograph shows what the camera registered when the photographer took a snapshot of soldiers at Camp Upton while they were going "over the top"—which is only one feature of the physical training which the Camp Upton men undergo in preparation for the fighting "over there." Punching a bag with a bayonet to accustom the soldier to hand-to-hand struggles, foot races, boxing matches and other sports make up their life in camp.

A class at the naval training station at Newport studying the various parts of a ship

Photos © Western Newspaper Union

The science of "boxing the compass" is taught to the naval recruits by aid of this ingenious device

Learning to be a Blue-Water Sailor on Dry Land

THE training of a man-of-war's man is not a simple matter. In days gone by it used to take almost as many years as it now takes months. The methods of instruction and of training have undergone wonderful changes; they have become much more intensive and to the point, and the results obtained prove the efficacy of modern methods.

Stations for the training of the future sea-fighters have been established at many points. At these stations the young men preparing themselves for naval service receive the most careful instruction and training, theoretical as well as practical, and in accordance with the most advanced ideas. Nothing could emphasize more strongly the difference between the present method of training and that which was in vogue in the olden days. Then the men were drilled in the most primitive manner; a rope's end usually played an important rôle as an educational factor. Now, with the help of models, the men are taught in one hour what would have taken days, weeks or even months under the old system.

Driving Your Car Through a Stream of Oil

This new transmitter solves the dual problem of power-waste and leakage of oil

FLEXIBILITY of operation is the great outstanding factor of power transmission by means of fluids, so far as the automobile is concerned. Fluids transmit power through the pressure exerted by the fluid on the part to be moved. The fluid is pumped by some means into chambers containing the parts to be moved, and since the fluids used are practically incompressible, the degree of pressure exerted is almost proportional to rate of flow or the pressure represented by that flow. It is a simple matter to change the pressure by merely changing the rate of flow.

This may be done by ordinary control means and gives such a wide range of different speeds that when a hydraulic transmission is applied to an automobile, the latter can be run at the speed best suited to the conditions of load and road instead of the three or four speeds provided in the ordinary sliding-gear transmission.

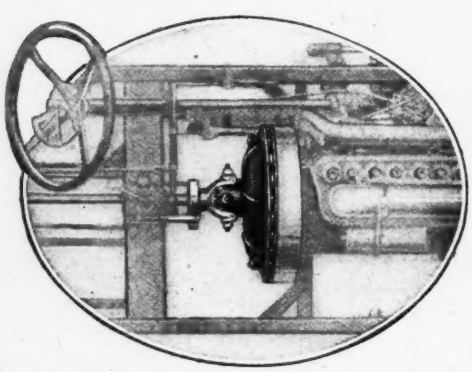
The hydraulic transmission supplies those speeds which the gear reduction cannot because the number of teeth in the meshing gears necessarily always remains the same. Again, the hydraulic transmission enables the pressure to be increased gradually from low to high speed. It also eliminates the clutch and does away with the attendant manual effort when changing speeds.

Parts of Power Transmitter

When engine is started, the blades of member attached to engine force oil against blades of housing mounted on propeller shaft, turning this and finally rear wheels. The oil flows back into a chamber at inner circumference of two housings, whence it again reaches blades of engine member, thus continually circulating within housings. Gentle flow eliminates the jerks caused by the clutch in ordinary cars

The hydraulic transmission of power in motor vehicles is not new. In some of the systems used a master pump is driven by the engine, and other smaller pumps drive the wheels, the oil reaching and leaving the smaller pumps through a series of pipes. Most of the pumps consume an excessive amount of power because of skin friction in the pipes or leakage of the oil. Sometimes both of these factors are combined.

Both of these difficulties seem to be solved in the power transmitter, which consists of a combination of a centrifugal pump and a turbine that can be inserted in place of the clutch in any car equipped with the ordinary gasoline-engine of the present day. There are no pipes. No changes need be made in the other power transmitting parts.

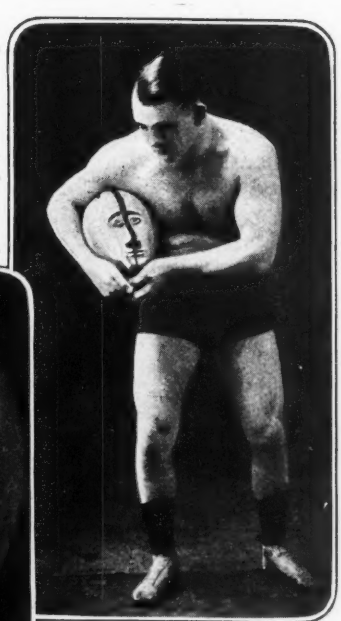


Showing the installation of a turbine as a substitute for the clutch

The turbine consists of but two moving parts, a driving member attached to the engine-shaft and a driven member, fastened to the front end of the propeller-shaft of the car. Both members are constructed exactly alike and are made up of two circular housings with blades or fins radiating from a central rectangular chamber. The two members stand apart and touch only at the bearings on the shafts. The space inside the housing is partially filled with oil. When the engine of the car is started, the blades of the member attached to the engine force the oil up against the blades of the housing mounted on the propeller shaft so that it, and finally the rear wheels are turned to make the car go. The speed of the car is controlled by the throttle, although the device may be thrown out of contact with the flywheel if it is necessary to shift the gears in the usual manner.

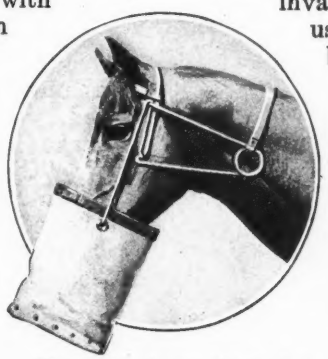
As long as motor-driven vehicles are used, the quest for improvements and labor-saving devices will go on, stimulated partly by economic dictates and partly by the inherent inclination in the human race to simplify mechanical contrivances.

"Strangler" Lewis, the famous wrestler, uses the dummy for exercise



Making It Easy for Old Dobbin to Eat Out of the Feed Bag

THE feed-bag support invented by William Meier of Jersey City, N. J., is designed to overcome the difficulties invariably connected with the use of the feed bag. This bag is provided with a spring so that it will adjust itself when the food gets out of reach of the horse as it diminishes in quantity. Even under the most favorable conditions part of the oats will be spilled in the horse's attempts to get at it. Mr. Meier's invention consists of a yoke-shaped frame of heavy spring wire, which is suspended from the head and neck of the animal in the manner shown in the illustration. The bag is suspended by a cord running through a loop of the spring.



The spring keeps the feed bag adjusted so that the horse can get at the oats

Practicing the Head-Hold with a Wooden-Headed Adversary

BOXING with a dummy which can't be knocked down is a well-known and recognized form of training for pugilists, but hitherto wrestlers have been rather unprovided for in this respect. Now, however, Mr. B. C. Sandow, of Rochester, New York, has brought out a dummy head to train a man to give enormous pressure in the head-lock.

This apparatus is a wooden, life-sized head, made in two equal pieces divided down the center of the face. The halves are kept apart by three coil springs. The wrestler practices squeezing the halves together, as he would in the head-lock, until he can conquer the tension of the springs.

A great cooker for campers, and a boon to the housewife in summer

You Can Carry It in Your Hand and It Saves Fuel

IT is expensive as well as uncomfortable, in warm weather, to use a gas oven when the same result can be obtained by using one of the burners on the top of the stove. But how can you roast on such a burner, you ask? The answer is found in an efficient cooker which has recently made its appearance.

The new cooker, built of cold rolled steel, consists of six parts—an asbestos-lined hood, a base with a removable heat deflector (also asbestos-lined), a perforated corrugated circular steel plate which acts as an equalizer for the heat, and a wire stand. Extra strength is obtained in the manner in which the corners of the base and hood are folded

When used as an oven the cooker bakes perfectly. It is large enough to bake two loaves of bread at once, a fowl or enough of any food sufficient for the dinner of an average family. The equalizer, used without the hood, is of great assistance in cooking or frying as it spreads the heat evenly under the pot or pan.

No Footprints Are Left by the Gasoline Lawn-Mower

THE lawns of the golf-club need trimming and the horse-drawn mower has been at work since early morning. Up the gentle slopes and down again on the other side old Dobbin is pulling the heavy cutter. When the blades of the mower encounter thicker grass, Dobbin slows up and the increase of resistance caused by a little hummock is sufficient to make him stop altogether, until a sleepy "Gidap" from the driver stirs him to a renewal of his labor. Streaks and holes appear at intervals, which invariably cause dissatisfaction on the part of the golfers.

Because of Dobbin's inefficiency a western country golf club decided to purchase the converted Ford motor lawn-mower shown in the accompanying illustration. It leaves no hoofprints, does not tear up the sod and pulls with such evenness that the grass is almost as smooth as the top of a billiard table. Besides, it does the work of two horse teams and at a smaller cost.

The tractor consists of a regular Ford runabout model with wide metal wheels in the rear. It is run on second gear when pulling the mower and is provided with a water pump to circulate the engine water properly at the continuous low speed. To prevent the water from being spilled out of the radiator when the tractor is going down sharp inclines, a gallon can it attached to the radiator cap as shown in the accompanying illustration.

Hitch your Ford to a lawn-mower and you will secure a velvety lawn without giving a horse nervous prostration

When the Moon Darkens the Sun

What astronomers will look for during the June total eclipse of the Sun

By Calvin Frazer

A TOTAL eclipse of the sun is one of the most awe-inspiring spectacles in the whole repertory of Nature. Its overpowering effect upon the human mind is illustrated by an episode which the present writer recalls in connection with the eclipse of May 28, 1900, as seen at Norfolk, Virginia. The weather was superb, and the town was crowded with visitors; besides whom the natives were all on the streets. During the period of about an hour following "first contact," while the disk of the moon encroached more and more upon the face of the sun, the spectators, white and black, kept up a lively chatter of conversation. Probably most of them found the phenomenon rather tame, and wondered why people should travel miles to see it. Just before the beginning of totality the light of day faded with startling abruptness, the beautiful solar corona flashed out, the stars appeared in the sky, and a ruddy glow, as of late sunset, encircled the horizon. The babel of conversation ceased instantly, and was succeeded by the *crash of breaking glass*. Totally unprepared for so marvelous a sight, many people, especially among the colored population, let fall the pieces of smoked or tinted glass through which they had been viewing the eclipse!

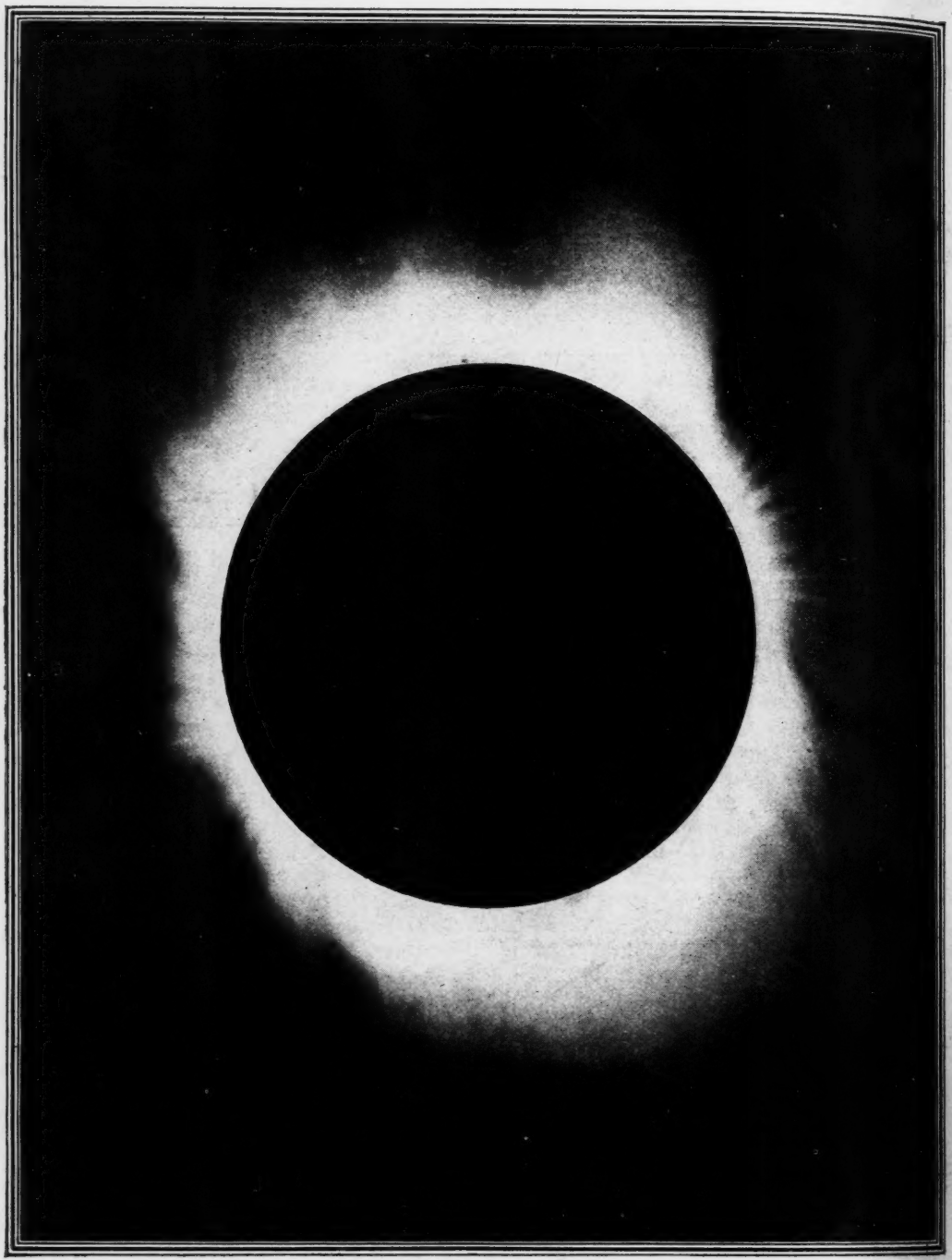
Renewed efforts will be made at the coming eclipse to solve the mystery of the flickering "shadow bands," which steal over the ground at the beginning and end of totality. Former attempts to photograph these "flickerings" were not successful

Interesting to the layman as a spectacular event, a total solar eclipse is even more interesting to the astronomer as a rare opportunity for obtaining fresh light on a wide range of scientific problems. Hence, in order to observe a process of Nature lasting generally only two or three minutes expeditions are organized and equipped at great expense, and sent perhaps halfway 'round the world to some favorable vantage point. After arrival, many weeks are spent in setting up and adjusting instruments and rehearsing every detail of the observations, so that the advance program may be carried out without a hitch at the proper time. Every precaution is taken to economize to the utmost the precious seconds available during the event.

After all these preparations, the astronomers in many cases get no results at all, owing to unfavorable weather. A single cloud may blast their hopes. The party sent from the Lick Observatory to view the eclipse of 1900 encountered a citizen of Georgia who was frankly skeptical about their ability to foretell the occurrence of the eclipse, and his doubts deepened to positive disbelief when he heard the observers anxiously speculating about what the state of the weather might be on the eventful day. "These young men," he said, "try to tell me they know the sun is going to be eclipsed, and they can't even tell whether the sky is going to be clear!"

Unfortunately the only help the meteorologist can give to the astronomer in this matter is to tell him what the average weather has been in previous years on the

The Sun's Glorious Corona in Total Eclipse



Photograph by Yerkes Observatory

When the Moon Masks the Sun's Face

Only during the fleeting minutes of a total eclipse may the Sun's weirdly beautiful Corona be seen. It is a pearly white glow, like a halo, which extends in an irregular outline millions of miles into space. Photographs will be made of the Corona, as usual, to determine its size and outline, which varies a great deal from one eclipse to another and appears to be related to the frequency of the sunspots. It is hoped also to obtain good cinematograph pictures of the total solar eclipse on June 8, 1918, and many problems hitherto not accurately determined are expected to receive clarification at this time.

date in question, and such information always plays an important part in the selection of sites for eclipse observations. Generally speaking the chances of favorable weather are best along a line from eastern Oregon through Idaho and Colorado, and this will be a favorite part of the track for the further reason that the sun will be higher in the sky at the time of the eclipse than farther east.

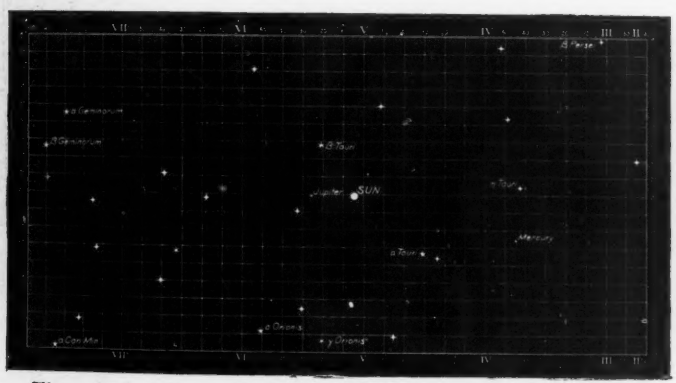
The world over there are about 70 total eclipses of the sun in the course of a century, but at any one place on the globe there is, on an average, only one in about 360 years. In the whole present territory of the United States (outlying possessions not included) there were only eight total solar eclipses during the nineteenth century, and there will be the same number during the present century: viz, in 1918, 1923, 1925, 1945, 1954, 1979, 1984 and 1994.

A Case Where the Moon Obscures the Sun

The fundamental facts relating to a solar eclipse are quite simple. The moon, in her monthly revolution around the earth, occasionally passes between us and the sun. The moon has no light of her own, and when she shines it is by reflected sunlight. In a solar eclipse her unilluminated side is turned toward us, so that we see her as a black disk, intervening in front of the sun. The reporters who write up scientific events for the newspapers often refer to this disk as "the shadow," through confusion with eclipses of the moon, in which the darkening is due to the shadow of the earth. What we see is not a shadow, but the moon itself. The sun's diameter is about 400 times as great as the moon's, and the sun's average distance from the earth is about 390 times that of the moon. The attached diagram, which is correctly drawn to scale, shows the long, tapering shadow cast by the moon as she revolves through space, and shows why there is only a small area of the earth's surface from which, at any one time, the sun is completely hidden by the moon. Owing to variations in the distance of the moon and the length of her shadow, there are some eclipses in which the latter does not reach all the way to the earth. Under these circumstances an observer directly in the line passing through the sun and moon sees, at the time of eclipse, a circle of sunlight extending all around the lunar disk, and the eclipse is said to be "annular."

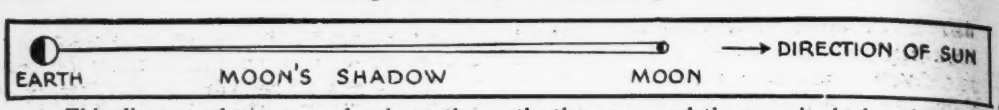
The Moon's Shadow a Fast Traveler

The shadow cone on June 8 will first touch the earth at sunrise in the Pacific Ocean, not far south of Japan. Thence it will sweep eastward, entering the United States in southwestern Washington at 2:55 P. M., Pacific Standard Time. It will then be traveling at a speed of 33 miles a minute. Striking southeast, it will cross the Mississippi River at 5:37 P. M., Central Time, reach the coast of Florida at 6:42 P. M., Eastern Time, and leave the earth after reaching the vicinity of the Bahamas at sunset. The actual time required for the journey across the United States (from 2:55 P. M., Pacific Time, to 6:42 P. M., Eastern Time) will be 47 minutes. "Daylight saving" necessitates the adding of an hour to these times.



The principal heavenly bodies, which will be visible near the sun during the eclipse. Although many astronomers have given up the hope that any planet or planets moving within the orbit of Mercury, the planet nearest the sun, will ever be found, the search will be continued during the coming eclipse

The coming eclipse will be observed by parties from all the leading observatories of America. But for the unhappy state of public affairs abroad, we should

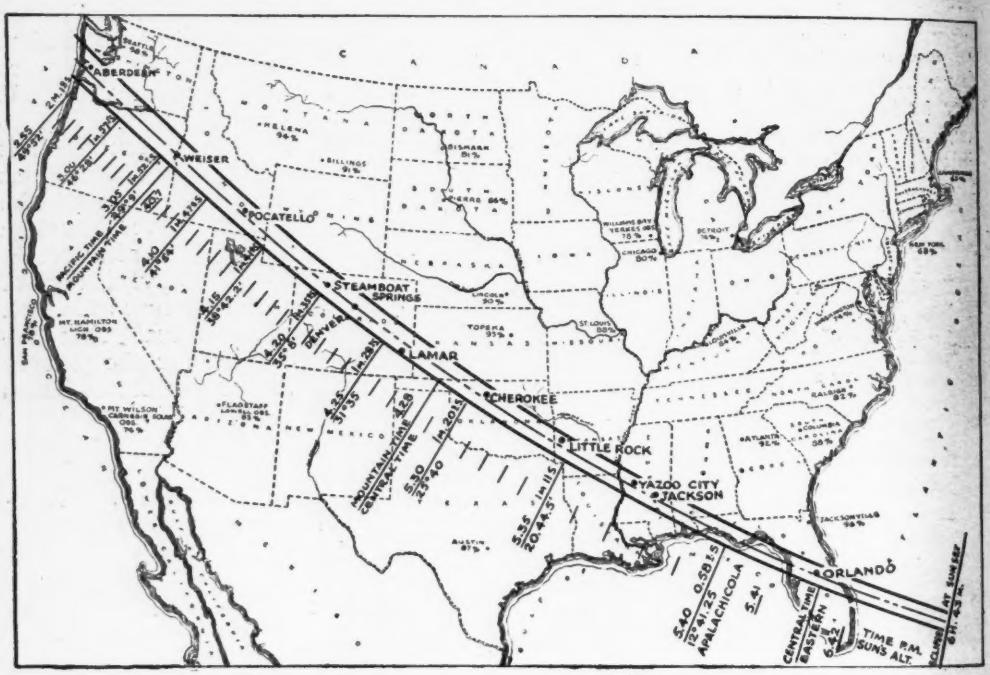


This diagram, drawn to scale, shows the earth, the moon and the moon's shadow during the eclipse. The distance of the sun is 390 times the distance between earth and moon

have had the privilege of welcoming scores of astronomers from Europe. One large American observatory—the Chamberlin Observatory, at Denver—will not need to send out an expedition, as it is situated right in the path of totality. The unusual length of this path within accessible territory is a particularly favorable circumstance, for the reason that observers at western stations, after viewing the eclipse, will have ample time to telegraph to those at eastern stations, calling attention to any features that especially demand further observation.

By hiding the sun and cutting off the glare of sunlight in our atmosphere, an eclipse makes it possible for us to see the envelope of incandescent gases by which the sun is surrounded, known as the *chromosphere*. Beyond the chromosphere, and extending millions of miles into space, is a pearly white glow, of irregular outline, known as the *corona*. By means of a marvelous instrument called the spectroscope astronomers are able to see and to photograph the chromosphere and its prominences at any time; but the corona can never be observed except during a total eclipse. The spectroscope is also applied, while an eclipse is in progress, to a study of the chemical composition and the movements of these solar envelopes or atmospheres.

In past eclipses eager search was made, by photography and otherwise, for a possible planet, or planets, lying within the orbit of Mercury—the nearest to the sun of the planets now known—and observations of an "intramercurial planet" were occasionally reported. These observations were, however, undoubtedly erroneous and astronomers the world over have generally given up hope of finding such a planet.



About eighty-five towns are directly in the path of the total eclipse. Since we are saving daylight add an hour to the times on the map. The track of totality extends from Washington to Florida. Outside of this track, in a belt varying in width from seventy miles at its western end to forty-five miles at its eastern, a partial eclipse will be visible

Photograph by Yerkes Observatory

Great masses of glowing hydrogen are tossed up as far as three hundred thousand miles from what is called the "chromosphere," an irregular scarlet rim which will be seen surrounding the moon's disk. This rim, however, can also be studied even when there is no eclipse

Scientists Will Test New Theory

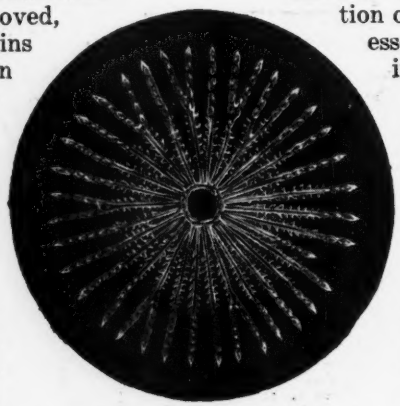
During the coming eclipse the region around the sun will be most carefully photographed for another purpose, and one which constitutes a novelty in eclipse observations. According to the new theory of relativity, which is now exciting so much discussion in scientific circles, there should be a very slight displacement in the apparent positions of stars seen close to the sun, owing to an attraction exerted by the latter body upon beams of light passing near it. This displacement will perhaps reveal itself on the photographic plates.

Other new features to be observed will be the effects of the moon's shadow on radio signals and the presence of electric waves in the atmosphere.

Something to Lose Sleep Over—Can Fish Hear?

CAN the humble minnow, or any of his larger brethren, hear? He has ears, but are they any use to him? Some scientists have experimented and said "Yes!" while others have experimented and said "No!" However, recent study seem to indicate that fish *do* hear.

Some of the fish experimented upon had their ears removed, and others had their skins made insensible. Then sounds were made in direct contact with the water, but without agitating it at all, and signs of hearing looked for. It was found that fishes are influenced by sound. One of the most peculiar and striking manifestations was the fact that a fish that had had its hearing organs destroyed lost its sense of direction when swimming fast. It could swim straight slowly, but as soon as it attempted to put on speed it went round in spirals. Considering that many species of fish travel considerable distances during their periods of breeding and depositing their eggs, such loss of direction would tend to make them easy prey for their enemies.



Crown of breathing hairs belonging to Chameleon fly larva

Crowns On Their Tails. The Queer Forms of Some Flies

"UNEASY lies the head that wears a crown," doesn't apply to the larvae of certain soldier flies; for their crowns are at the ends of their tails.

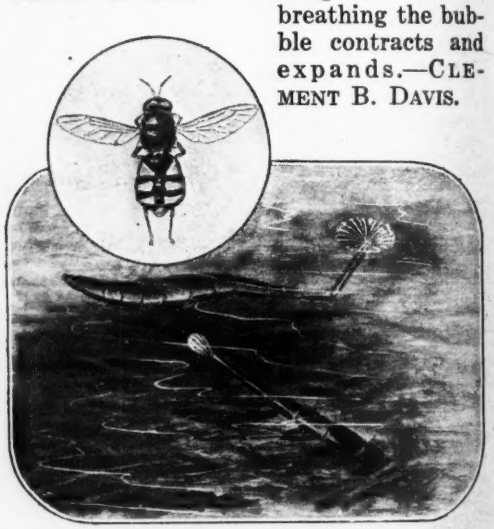
The adults (as one of our pictures shows) are rather stout-bodied, unfamiliar insects, although about as many species as there are horseflies occur in this country. They frequent the flowers in marshy places and derive their name from their brilliant coloring.

The larval period of different species is passed in the earth, in damp moss, decaying wood, ants' nests, fresh and brackish water. Some are believed to be parasitic in bee hives. To add still further diversity to their choice of breeding places one observer states that he found them in a hot spring in Wyoming, where the water was estimated to be but twenty or thirty degrees below boiling point—a decidedly close parallel to the salamander's mythical capabilities.

The particular one of this family which takes such decided liberties with the prevailing mode of wearing one's crown, is the larva of the Chameleon fly. In his case the crown is no mere decoration or emblem of rank, but an essential organ in his breathing mechanism.

His crown consists of about thirty many-barbed hairs radiating from a central disk containing two perforations for the outlets of the breathing tubes.

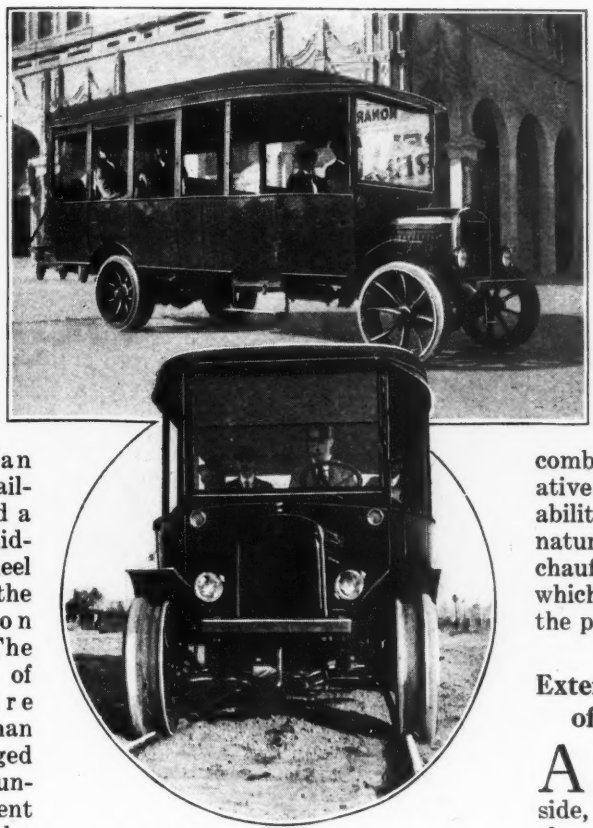
In the surface attitude the body hangs downward suspended by the crown of hairs, which crown lies almost flat on the water forming a very shallow funnel, allowing free entrance of the air to the breathing tubes. On leaving the surface, the hairs bend inward, enclosing a glistening bubble which serves to enclose air for breathing, while the little creature wriggles about among the mud and debris at the bottom of the pool in search of food. During the act of breathing the bubble contracts and expands.—CLEMENT B. DAVIS.



In the circle, the adult Chameleon fly. Below, two larvae, showing crown closed and open

Automobile or Railway Car—Which Is It?

A CALIFORNIA inventor has devised a method which will enable an ordinary automobile omnibus to run on railroad rails as well as on city pavements and country roads. It's an old idea, of course, but with modern "improvements." The Californian bolts a flanged railroad carwheel and a conventional solid-tired truck wheel together, with the rail wheel on the inside. The circumference of the solid tire wheel is larger than that of the flanged wheel. When running on a pavement of macadam the flanged wheel does not touch the ground at all. It comes into action only when the car is running on rails, as shown in the picture. Small wedges, placed alongside the track, permit the omnibus to run on or off the rails without difficulty. The system has been tried out on a suburban bus-line in California and has given good satisfaction. It enabled a California motor-bus company to open up new territory between Holtville and El Centro, between which there was no suitable road but a slightly used railway line. The bus picks up its passengers on the city streets and then runs to the railroad line over which it makes its trips. It will probably add a new word to the dictionary when some philologist shall succeed in constructing a term that fits this dual-service car. "Autorail Car," for instance, or some other suitable combining form indicative of the car's ability to change its nature at the will of its chauffeur or engineer, whichever title may be the proper one.



The wheels of this omnibus will run smoothly on ordinary railroad rails, city pavements or country roads

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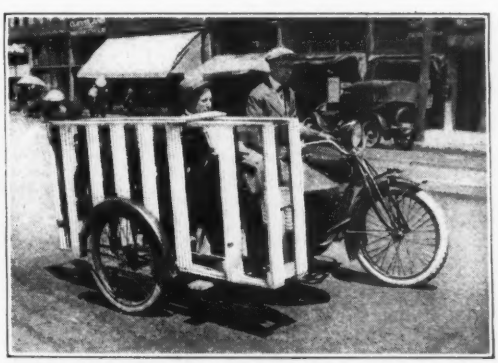
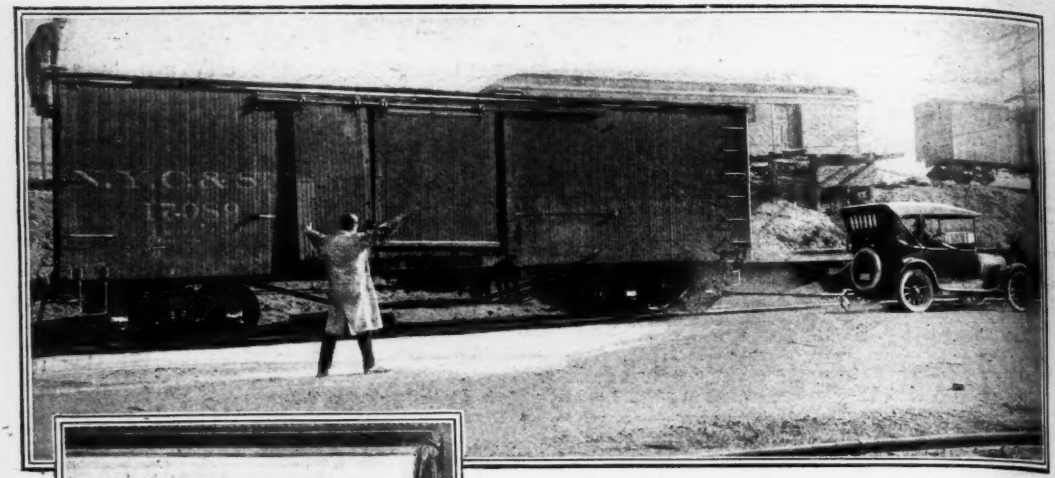
Extending the Use of the Sidecar

A MOTORCYCLE dealer in Riverside, California, finds the sidecar arrangement improvised by him to change ordinary motorcycles into delivery trucks very useful in his own business to carry crated motorcycles from the nearest distributing point, Los Angeles, to Riverside, a distance of fifty miles. The trip to Los Angeles and return is made in four hours and requires about fifty cents' worth of fuel, while the railroad freight on the crated machine would cost $2.50, and delivery could not be expected in less than three or four days.



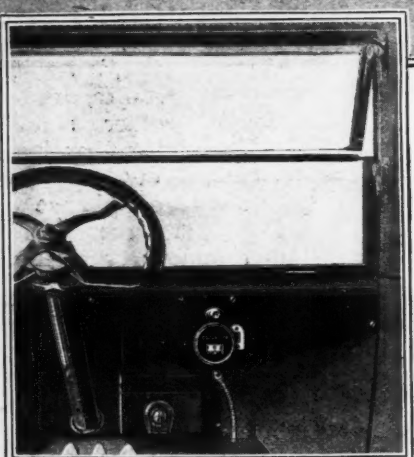
Sidecar arrangement which is decidedly useful for the delivery of crated motorcycles

New Ideas in Automobiling and Trucking



Hauling Freight Cars by Automobile

When the freight-car shortage became serious, and proper switching facilities were inadequate, a manufacturing company used an automobile to move cars to the place for unloading

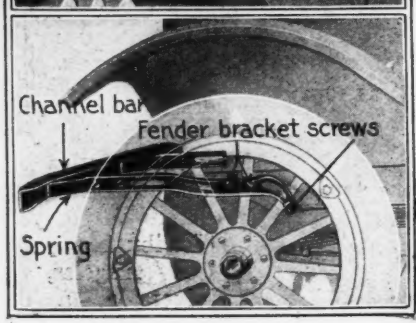


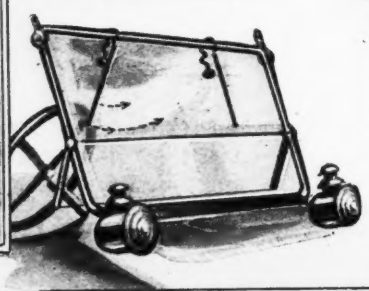
Another Ford Accessory

An instrument board attachment for a Ford car on which a speedometer is placed is shown in illustration at the left

Keeping the Windshield Clear

Below is shown a windshield wiper made of a small piece of wire covered with rubber, which is drawn across the glass horizontally





Garagemen, Please Notice

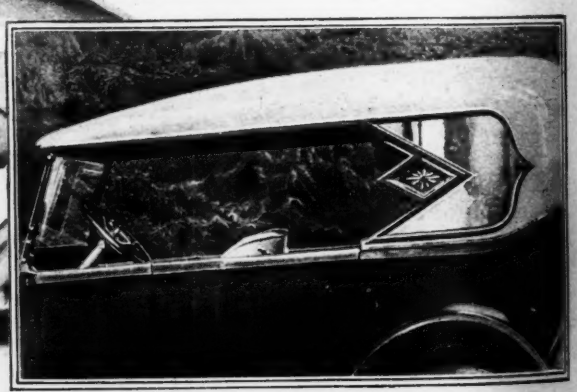
A stand for holding an automobile engine. It permits the engine being swung in any desired position with great ease

Just for the Eye

A fancy cut glass side for an automobile top. The glass is set into a frame made of metal

Safety First

An especially designed auto-guard that equips a car as if it were built-in. It consists of channel bar, springs and brackets



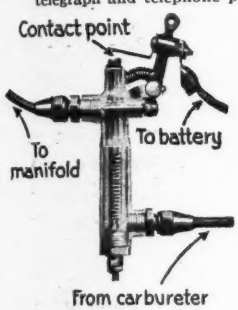
Doing It Gently

This flexible coupler for automobile transmission eliminates much of the jarring usually resulting from the sudden speeding of the engine

New Ideas in Automobiling and Trucking

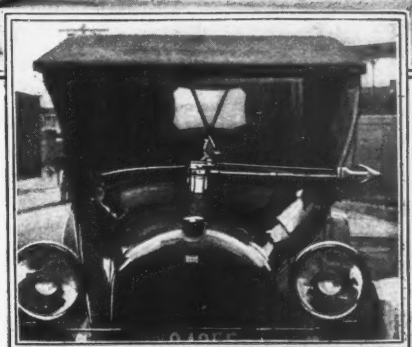
Undaunted Even by Length

This automobile trailer makes it an easy matter to transport telegraph and telephone poles over streets and country roads



Saving Your Arm Muscles

A swinging arrow arm used on wind-shield to designate the course to be taken is shown at the right. Operated by driver from the steering-wheel

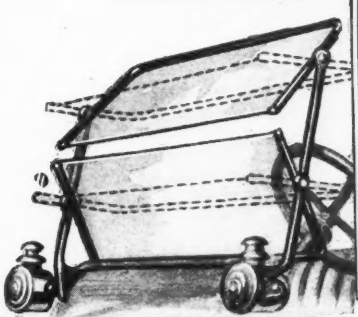


Many-Use Shield

The small car wind-shield shown below can be made ventilating, slanting or rain vision

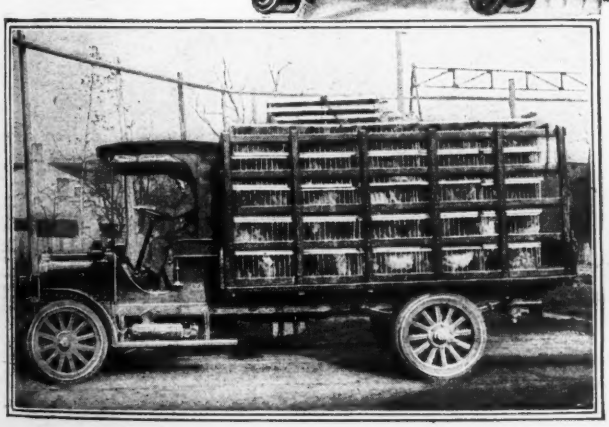
Good for Starting

A master primer in which an electric coil is used to bring gasoline to the proper temperature for vaporizing



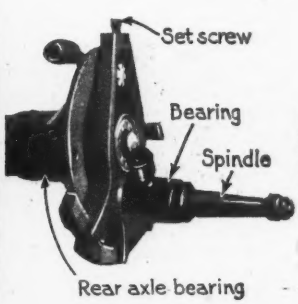
Motors for Chickens

Below is shown how Kentucky farmers haul live chickens to the market on motor trucks



Motor-Comfort

A leather case with a transparent front holds the road guide book and keeps the air from turning leaves



For Fords

An auxiliary axle attachment for a car so that it can be towed home on its own wheels in case of a breakdown

Railways That Run Under Water

Visit the fishes in their homes as you travel on the Aquarium Circuit

AS tunneling is costly and often very difficult, the idea of running railway cars upon the bottom of a waterway has its attractions. Air is more easily supplied to the passengers of an under-water car trip lasting, say, one hour than for submarine boats. But the bottom of water is rarely so smooth or firm that rails can be laid on it. In most cases a vast amount of grading and ballasting would have to be done before the ends of the rails could be joined. The under-water car, full of air as it is, would naturally be lighter than water and its buoyancy would cause an upward pull on the rails, which must be shaped accordingly and anchored down securely. Then, in water with ship traffic on the surface, some precautions would have to be taken to prevent ships with deep draft from cutting the submarine car from above, with disastrous results. These and other difficulties have made the counter-attractions of a good ferry seem more powerful for practical transportation purposes, and the submarine car so far finds its existence limited to amusement enterprises, where it may combine entertainment with instruction.

All that is wanted for this purpose is an airtight car which can be hauled under or partly under the water in an artificial pond by means of a cable. Through the windows the passengers can observe realistic imitations of submarine life and scenery staged in the pond. If the movements of the car are made to suggest the roughness of an ocean bed the illusion is improved.

One of the first schemes of this kind was hatched by Alexander Davidson—of Joliet, Ill., far from the ocean.

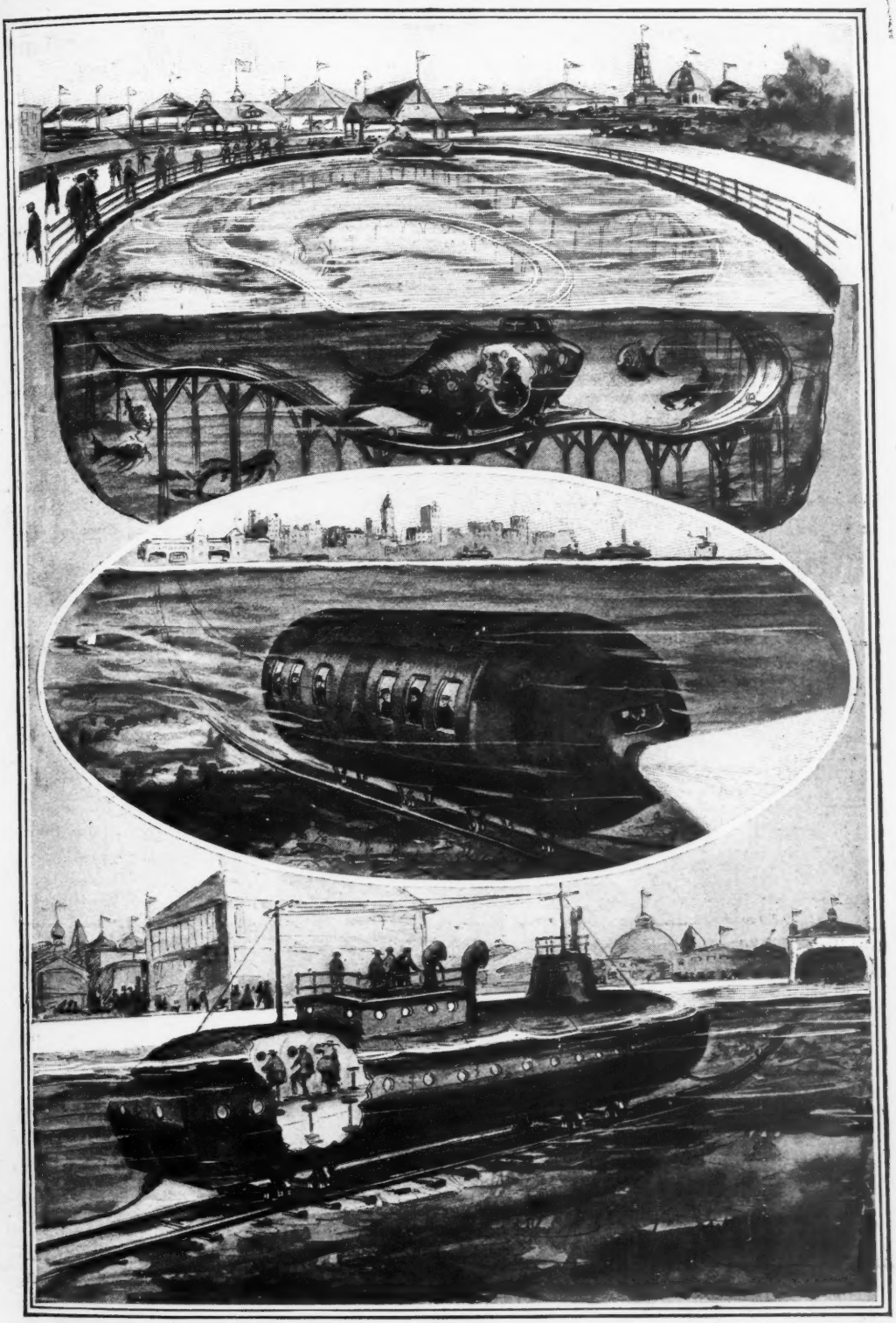
Instead of hauling his car with an endless cable, as shown in the illustration, Davidson suggests that the car could simply be allowed to run into the water by gravity and could be hauled back by a cable attached to it, as indeed would be necessary whenever, as in the case of a river or a large lake being utilized, a continuous cable is impracticable.

Charles B. Stahl of Philadelphia discovered that a little more illusion than the Davidson car provides would be desirable, and he fancied that it helps in this respect to shape the car as a submarine boat, a whale, a sea-serpent or a fish, but his main idea is to supply a track which rises and drops, so that the car will appear to dive one or more times to the bottom of the body of water. With this in view he builds his track as two parallel rails secured to a trestle of varying height, and the track rails are engaged from below as well as from above by little wheels journaled in brackets supporting the car at its sides. The claim set forth in his patent is limited entirely to this feature.

More illusion and still more illusion is the cry of the amusement resorts, and so it is found that the submarine "amusement apparatus" devised by Jacob Gunzendorfer of San Francisco responds to this demand with some new features "to simulate the actual sensations, scenes and experiences met in traveling in a submarine boat." He dispenses with the car effect in favor of the undulating and swaying motions of a boat, the track being made wavy and tipping laterally in places for this purpose. His means for holding on to the track are similar to Stahl's, and also his traction cable which pulls the car over a continuous circuit of inclosures filled with water or water marvels. But his car is never entirely submerged. The "conning tower," where the gripman is located, and some air pipes project above the water-line for the sake of safety and simplicity. As the passengers enter by a hatch which is afterwards closed above them by folding doors, they see nothing but the ceiling when looking up, and their illusion does not suffer.

The genius of Gunzendorfer comes out strongest in that he can get along with very little water. As he explains: "The trackway first passes into a tank a little distance beyond the elevated loading platform" where the start is made; "the

Underwater Railways



Three Different Inventors' Ideas of Traveling on the Ocean's Bed

The picture at the top shows Stahl's plan of a submarine car shaped like a monstrous fish and running on a "scenic railway" track. It dips and jumps in a manner suggesting the evolutions of a porpoise Davidson's idea is a cylindrical car running on a track and hauled by a cable, while Gunzendorfer favors the illusion of a submarine of conventional form which has convenient observation portholes

tank being so constructed as to give the appearance of a lake or river." This last master trick in illusion-making is, however, not explained but hides under the easy phrase: "so constructed." He continues: "The track, however, soon emerges from the tank and the rest of the course passes through inclosures, all above the water line, the interiors of which are decorated and illuminated to produce various effects. " The first inclosure may be entitled Submarine View. "Here will be seen sharks, divers, sunken wrecks, marine growths, etc." The next inclosure is advertised as Under the Ice at the North Pole. "Here arctic views may be shown, such as seals, walrus, Eskimos." Iron balls suspended within the inclosure and in the path of the vessel (the car) produce by contact a grating or grinding sound "in imitation of icebergs striking the vessel." Such is the inventor's idea of an iceberg! The portholes through which the passengers view the wonders "are provided with convex lenses which produce the desired illusion of distance, swirling motion, etc." In other words, they blur the vision to make the passenger's imagination work more willingly. "The illumination of the different inclosures is controlled by the passage of the submarine," by electric contacts on its dummy periscope.

Altogether, there should be shocks enough in a trip like this to provide the least fertile imagination with thrills sufficient to last the average individual quite a while—and, incidentally, to make him profoundly grateful that the trouble *is* imaginary. Without that comforting knowledge enjoyment would be dubious.

Sleep in Your Automobile and Hang Up the Baby for the Night

A RESIDENT of Tropico, California, has devised the novel automobile bed equipment shown in the accompanying illustrations. It accommodates two grown-ups and a child, adds not more than twenty pounds to the outfit and takes up no more room than an ordinary "camper's" roll of bedding.

This shows how you can arrange beds for two adults and one baby in your automobile

The back of the front seat is cut down so that it can be dropped backward, to fill the space between the front and the rear seats. This makes a bed of the interior of the car, large enough to accommodate two grown persons. The bed for the youngster consists of a hammock, which is swung above the bed. This hammock may be made of duck, about thirty inches wide by fifty-two inches long.

The Secret of the Wily Snake's Sinuous Glide

DID you ever watch a snake gliding over the ground in graceful curves and did you ever stop to think of the mechanical principles involved in its motion? The snake moves along the ground in undulating curves produced by the contraction of the longitudinal system of muscles in alternate sections of its body. That alone would not produce a forward motion, however, were it not for the friction of the scales on the underside of the snake's body against the roughnesses of the ground. By bracing the rear part of the body, the forward part is enabled to glide forward and by reversing the process the rear part is dragged forward to a new position.

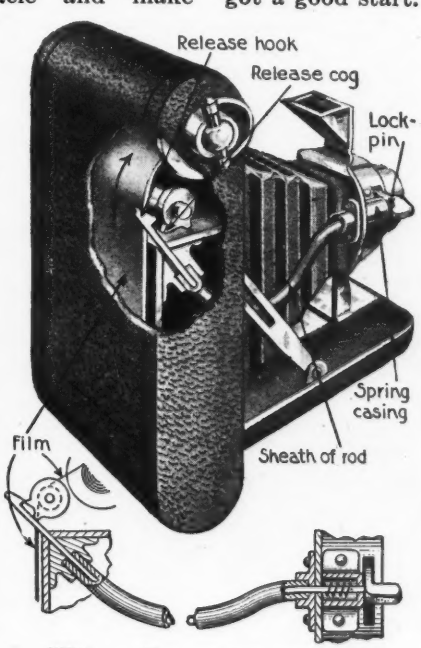
No Double Exposures with This Device

"BLESSED if I can remember," exclaimed Oscar, "whether or not I've wound the film after taking that waterfall a little while ago! I think I'll give it another turn for good luck!"

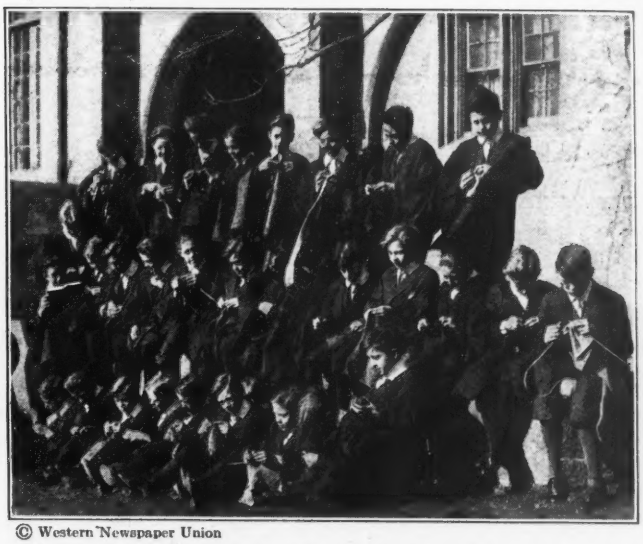
When the film roll was developed Oscar found a blank next to the negative of the waterfall and a double exposure in another part of the film.

To put an end to such uncertainty, Oscar—his full name is Oscar Howard Wilber, Jr.—has patented a very simple device which may be attached to any film camera at small cost. A flexible rod, sliding in a sheath, is so arranged, that after the trigger of the shutter of the lens has been pressed down to make an exposure, the front end of the rod is pressed forward by a spring so as to bar the trigger from returning to its former position. To remove the obstacle and make another exposure possible, the receiving roll has to be given another turn, which naturally brings an unexposed film before the lens. By turning the roll the film is drawn over another roll, provided with a disk at one end. That disk has a tooth which engages, at each revolution, the hook at the other end of the flexible rod, pulling it back and thereby releasing the trigger of the shutter for another exposure.

This clever device will spare many an amateur photographer the disappointment of losing, by double exposure, a picture valued for its happy associations with a pleasant vacation.



With a film camera equipped like this one even the most forgetful of amateur photographers cannot make a double exposure



© Western Newspaper Union

These choir boys take knitting seriously and do good work

Knitting Is Not by Any Means Confined to the Ladies

OF course Sister Susie's been sewing shirts for soldiers for some time now, and has also been knitting sweaters, socks, scarfs, etc.; consequently she has got a good start. Still, she must look to her laurels, for there is a valiant host of rivals springing up—the boys are taking a hand. In our illustration is seen a group of Cathedral choir-boys in New York, who have (ostensibly) foresworn horseplay and mischief in the intervals of waiting, and are seriously knitting comforts for the soldiers and sailor-boys. They have been properly and thoroughly instructed and are turning out just as good stuff as their sisters do. The boys display a remarkable seriousness of purpose in their new task and no longer consider knitting as mere girls' work unworthy of the attention of a manly boy.

Notch the Curb to Keep Out Automobiles

CALIFORNIA automobilists frequently mistook a motorcycle for an automobile garage and drove in with their machines. When the drivers learned their mistake they turned around and left, frequently knocking over and damaging some of the motorcycles in the garage. The owners of the garage used a very simple and effective method to keep automobiles out of their place without interfering with the passing in and out of the motorcycles. They had the inclined driveway to their garage supplanted by a curb, too high to be scaled by automobiles. For the use of the motorcycles a notch of liberal width was cut in the curb, offering a sufficiently wide and slanting runway to and from the garage. Now if a belated automobilist mistakes his goal he will be rudely awakened to the fact by a bump which will jar him in direct proportion to the force with which he hits that curb.

This notch in the curb permits motorcycles to pass, but bars automobiles very effectively

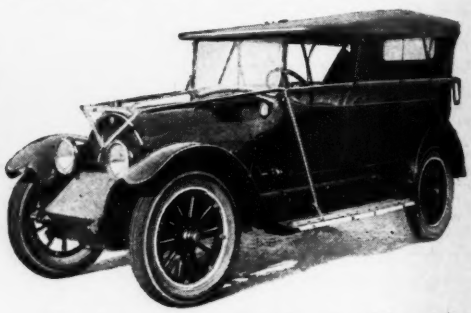
Putting Overalls on Automobiles for Protection

OWING to war conditions automobile manufacturers meet with increasing difficulty in securing box cars for shipping their automobiles to their dealers and agents. Many concerns are compelled to deliver nearly all their cars by running them overland to their destination. The cost of refinishing such cars after they have passed through rain or snow storms has become a serious question. It costs about one hundred dollars to drive one car overland from Detroit to Baltimore, as compared with thirty-four dollars by railroad. Any additional charge for refinishing the body simply adds to the cost of the car to the final purchaser.

To eliminate the charge for repolishing bodies scratched by mud, sleet, rain or snow, a Baltimore automobile dealer has invented the car overalls shown in the accompanying illustrations. Each set costs about thirty-five dollars and weighs thirty-nine pounds. It can be folded up into a parcel small enough to be put in a suitcase, to be carried back to the factory by the driver when he returns for his next car. The device consists of a padded stick across the front of the radiator, to which are attached strips of webbing which are stretched taut on each side of the car. They serve to button down pieces of rubberized top material that completely inclose the body, yet do not touch it. Strips of wood along each running board serve to hold the pieces out at the bottom and straps attached to the top serve the same purpose higher up. A separate covering fits over the radiator and front springs.

The right-hand picture shows how the padded framework and webbing are adjusted to the car, while that to the left gives an idea of the absolute protection against dirt and scratches which is afforded to the car body by its overalls.

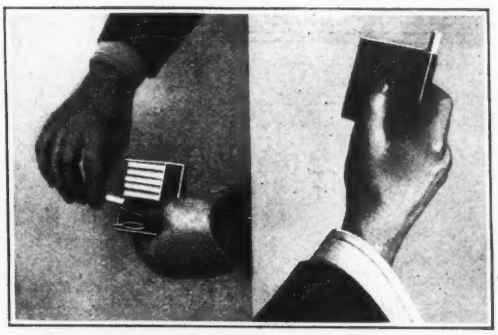
This shows an automobile dressed in its overalls for protection against scratches



Showing the framework of sticks and webbing which holds the overalls in place

Here Is That One-Hand Cigarette Case You Want

REMEMBER that time when you were in the car, dying for a smoke, and the traffic so thick that you couldn't take your hands off the wheel for an instant? Of course you could carry your cigarettes in the packet in your vest pocket, but they are crushed and they dry out. Here is a cigarette case designed to help you in just such emergencies.



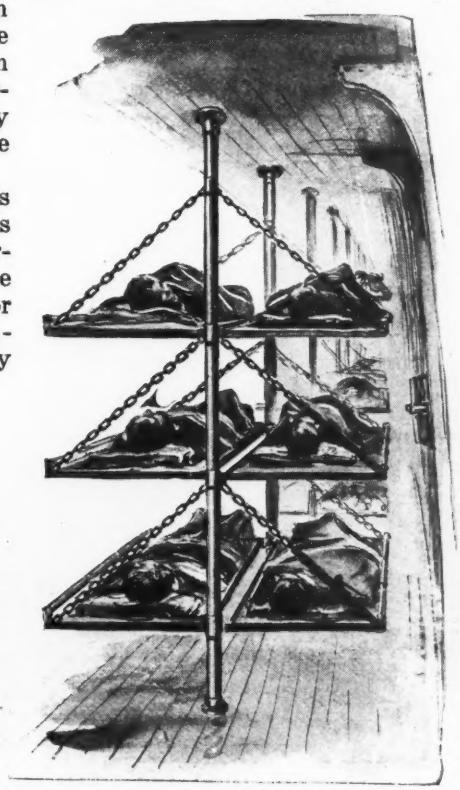
It's simple to get the cigarettes in and simpler to get them out—with one hand

You load the case when you start out by taking off the cover. After this you merely press down the cover with the thumb and push it back again. This causes a cigarette to be protruded about an inch so that it can be drawn out with the lips. A spring then pushes another cigarette into place ready for the operation to be repeated.

The magazine of this neat little device holds ten cigarettes of average size. The case may be made plain or ornamental as individual fancy may dictate.

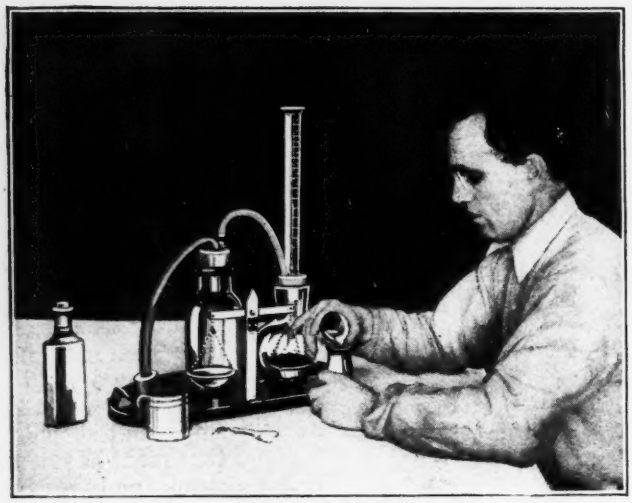
Use Folding Bunks to Economize Space on Trip "Over There"

OWING to the lack of ships the transports taking the American soldiers to France have to be loaded to their full capacity. In day time it is a comparatively easy matter so to distribute the men that there is no overcrowding in any part of the ship. But at night the men have to sleep, and to be able to do that they must have sufficient room to lie down. The difficulty of providing sleeping room for the men on overcrowded transports has stimulated invention. One of the simplest and best expedients adopted is shown in the accompanying illustration.



On the left the cots are folded. On the right they are shown as they appear when used as beds

Hinged to upright posts are three tiers of folding frames, the free ends of which, when in a horizontal position, are supported by chains. Each tier has two of these frames, which serve as bunks. The elastic wire netting supported by the frames forms the mattresses. When the bunks are not in use they are folded up against the posts, an arrangement by which space is greatly economized. Another advantage of these bunks is that they are easily kept clean and sanitary, and this is, of course, of the utmost importance where a large number of men are thrown together for several days in cramped quarters.



This apparatus will inform the farmer how much lime, if any, his fields require to make them productive

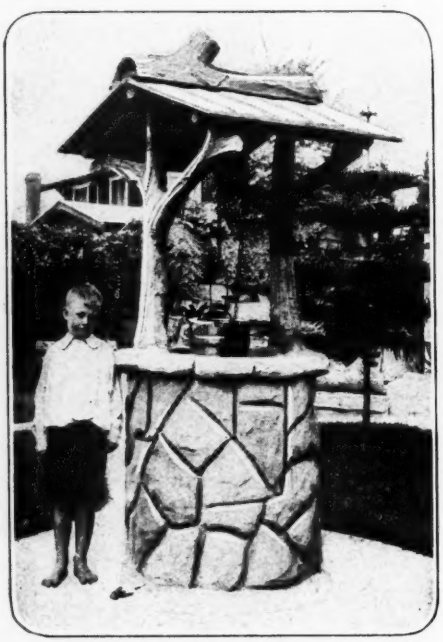
Every Farmer May Be His Own Soil Chemist

EVERY available acre must be made to yield to its full capacity if the United States and our allies are to win the war. Many soils fall short of their full productive capacity because they are sour or acid. This condition can be remedied by applying a sufficient amount of lime.

To overcome the difficulty of determining exactly the amount of lime necessary to neutralize the acidity of the soil a simple apparatus has been designed and placed on the market. A test requires but a few minutes. Representative samples of earth from various sections of the field are mixed to make the average soil of a field. The earth is dried, sifted and weighed in the scales which form a part of the tester, then placed in a glass bottle. A carefully measured amount of muriatic acid is poured into a smaller bottle. A definite amount of water goes into the third glass container, above which rises a marked gage. The three bottles are tightly corked and connected in series by rubber tubes.

The action of the acid upon the lime provided by nature in the soil creates a gas which passes into the tester and forces some of the water to rise in the gage. If no reaction results, it shows that no lime is present in the soil. If the water rises to the mark for three tons per acre or above it, the soil contains all the lime it needs. It should contain at least three tons in each acre and if the gage shows only two tons it means that the field requires an additional ton of lime for each acre.

The simplicity of the device makes it possible for the intelligent farmer to conduct his own experiments and apply the remedy called for, thus making it possible to keep the soil always at its highest degree of productiveness.



An imitation, in concrete, of an old Vermont well with "oaken" bucket

A Camouflaged Well-Curb

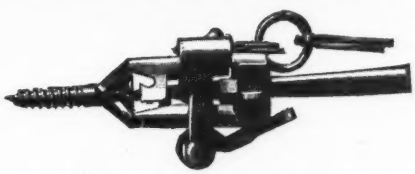
FOND memories of his childhood days on the old farm in Vermont induced R. E. Sperry, a resident of Inglewood, California, to place a replica of his father's well-curb in the garden of his California home. The curb, roof supports, roof, and even the "old oaken bucket," are made of concrete.

The well is a well in name only, obtaining its water supply from the city mains, but it serves the sentimental and picturesque purpose desired.

Holding the Screw to the Screw-Driver with a Vise-Grip

CARPENTERS, wood workers, machinists and other workers who use screw-drivers frequently have to do their work under conditions which make it impossible to use both hands at the same time in starting a screw. For many years the need was felt for some device that would hold the screw firmly against the edge of the screw-driver, that could be quickly put on and taken off and that would fit screw-drivers and screws of any size.

The man in the picture does not have to hold the screw. The device below does it, leaving his hands free

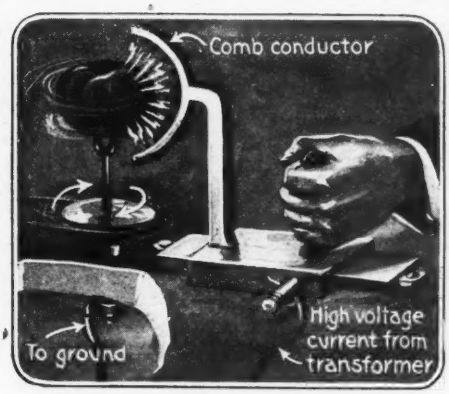


The screw-holder invented by David H. Royer, of Hartville, O., fulfills these requirements and is comparatively simple in construction. The mere turning of a lever closes the jaws and clamps of the device, so as to hold the screw and the screw-driver securely. By merely throwing back the lever, which works on the principle of an eccentric, the grip of the device is released so that it can be removed. To adapt the device for use with screws of different sizes, keys or wedges are used, which are inserted between the screw-holding part and the yoke, opposite the eccentric-lever clamp. Where screws are to be inserted at heights beyond convenient reach, or where lack of space interferes with the workman, this device should prove especially useful.

Electric Sparks Peel the Tomatoes. Here's How It's Done

WILLIAM H. CHAPMAN, of Portland, Me., discovered that electric sparks, if allowed to strike the skin of a tomato, will puncture it and, by expanding the air underneath the skin, loosen it from the pulp. He thinks that he has solved the tomato-peeling problem for canners.

The tomato or fruit to be treated is impaled upon a fork rotated around its long axis by a mechanically or electrically driven pulley. The fork is connected with an insulated wire which leads to the ground. A sliding base, operated by a handle, has, attached to the vertical post at its front end, a curved part lined on the inside of the curve with comb teeth of metal, through which sparks of a high voltage alternating current are allowed to pass to the impaled tomato or fruit. It is claimed that the device is very effective and does its work quickly and thoroughly. This invention will undoubtedly be of particular value to canning factories, where large quantities of tomatoes have to be peeled. For factory use, a modified form of the device is available.



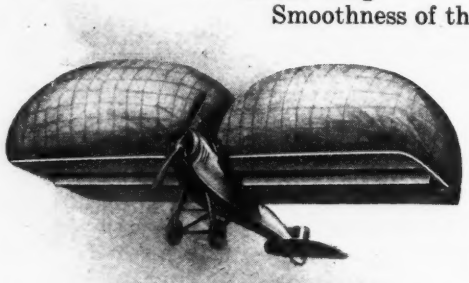
The high voltage sparks puncture the tomato's skin and loosen it

The accompanying illustration conveys an idea of the workings of this device. The power may be obtained from an electric or other form of motor.

Parachute Safety Device for Airplanes

A new attempt to revive the late Sir Hiram Maxim's idea of twenty years ago

OF his first machine Sir Hiram Maxim said, over twenty years ago, that, completely stalled in the air, it would "pancake" down with the velocity of a fall of four feet. But these old machines were loaded barely more than one pound to the square foot, and their center of gravity was far below their carrying surface. The arrangement, as we know now, prevented easy flight, but it made them good parachutes. The more perfect and efficient the modern airplane became, the more it lost its former likeness to a parachute.



By releasing the parachute and opening long slots in the wings through which the air rushes under the parachute, the descent of the airplane is made safe

The wings of modern airplanes bear a load of five to seven pounds to the square foot and the center of gravity has been raised. Stalling and pancaking are nowadays considered worse than upsetting and "looping the loop"; yet pancaking, that is, descending like a parachute, is obviously the safest way to land on badly broken, mountainous ground.

Very interesting is a revival of Maxim's parachute idea in modified form, by Gerrit Van Daam, because it aims at making safe not only stalling but also landing on the worst ground. It is not feasible with heavily loaded biplanes, since in their case one wing surface blankets the other; but with lightly loaded monoplanes of the Blériot type the plan may work out satisfactorily. What such monoplanes lack in surface for a parachute-like descent, the inventor makes up, more or less, by turning the wings into true, highly-arched parachutes of increased air-resistance.

A parachute is tightly folded over the whole upper surface of each wing, being held in place by a netting. When needed, this netting is instantly loosened, and at the same time a long slot opens along the center line of each wing, admitting the air from below into the spacious pocket formed by the distending parachute, now held only by the margin of the wing.

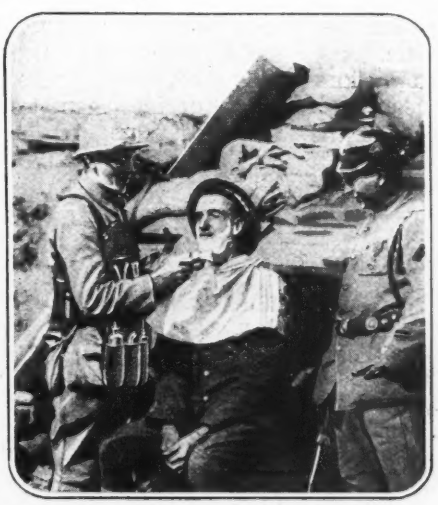
Smoothness of the wing tops in flight is absolutely essential; so the folded parachute and the netting will have to be covered, while not in use, by a smooth light shell firmly secured to resist the air suction, yet easily removed when necessary. Of greater importance is a device that will keep the pancaking airplane on an even keel during descent. That is not so easy with a machine of the Blériot type. In that machine, the tail makes an excess of surface toward the rear, while the advanced center of gravity, balancing the equally advanced center of lift, gives an excess of weight in front. The only remedy would seem to be control independent of the machine's headway, or adjustable rudders with a circular motion of their own, which remain efficient in a stalled machine.

Numerous attempts have been made in the past by inventors in many countries to utilize the principle of the parachute in safety devices, but the success has not been encouraging. Parachutes have been found useful and fairly reliable for dropping from observation balloons, but have failed to give satisfaction as a safe means of escape in practically all other cases. They have not been used extensively for military purposes; but perhaps this new device may solve a hitherto baffling problem and thus add to the balance of safety in the aviator's favor.

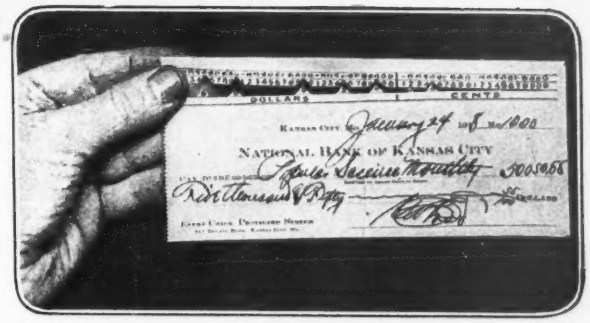
Trench-Dwellers Cherish the Barber's Ministrations

TRY to imagine yourself in the place of a soldier who has spent two or three weeks or months in the trenches, cut off from every comfort and at all times exposed to the risk of being killed or maimed by bullet, shell or shrapnel. The excitement of the first few days gradually wears off; but the discomforts of trench-life remain and become more irksome from day to day. Little rest, little food, no chance to bathe or even wash, no opportunity to get a shave or a haircut. Such is trench-life.

Can you realize what it means to a soldier who has gone through that life for many days and weeks, when at last he is relieved and sent to the rear of the fighting line? A soldier's first thouhgt is a bath, then a shave and a haircut, clean clothes and a hot and plentiful meal. Fortunate the man who has among his treasured possessions one of those comfort kits which, in a small compass and in practical arrangement, contain all the things necessary for a man's toilet: brush, comb, scissors, razor, soap, talcum powder, etc. The picture shows one of these kits which is particularly practical because it can be carried by a strap over the shoulder. It is thus possible to get an open-air haircut or shave with all the necessary adjuncts, though some of the comforts of the city barber shop may be lacking. But the soldier will scarcely mind this.



Trench barbering is frequently an outdoor operation. Our pictures show procedure and comfort-kit containing all the implements of the barber's trade



Check-raisers take notice. The amount to be paid is cut out of a double row of figures

Making Things Harder for the Forger of Checks

AN unusually clever device for protecting checks from being raised by forgery has been invented by C. W. Elrod, of Lincoln, Neb. The accompanying illustration clearly demonstrates the idea and its application. At the top of the check is a double row of figures indexing dollars, another double row indexing cents. The figures representing the amount of the check are cut out of that double row of index figures in such a manner that they appear on the little triangular tabs which in cutting were left attached to the check. The control-strip, detached from the check and forming part of the stub of the check, shows, cut out of the first row of figures, the figures representing the amount of the check, which may be identified by the corresponding figures in the second row. The inventor proposes to have the paper of the checks watermarked with the words: "Only good for amount shown on margin," as an additional protection against such forgery.

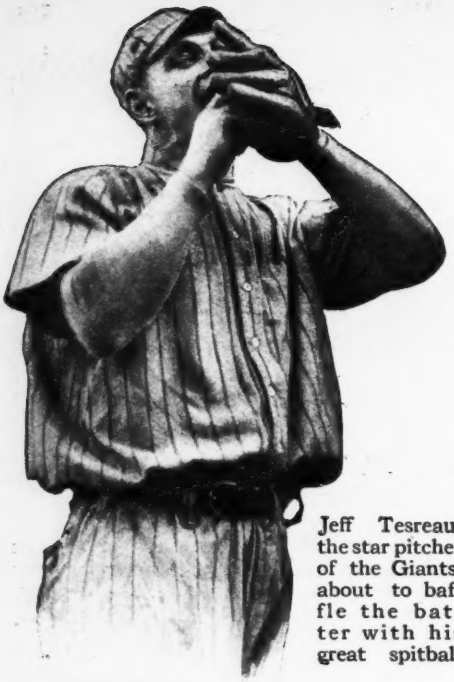
Those who have been victimized by bank swindlers will be glad of this ingenious means of protecting themselves hereafter.

Spitball Myths

Why pitched baseballs curve and why the spitballs are scientifically foolish

By P. A. Vaile

[Author of "Swerve, or the Flight of the Ball," "Modern Golf," "Modern Tennis"]



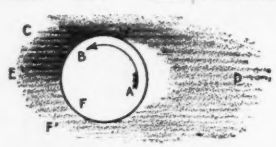
Jeff Tesreau, the star pitcher of the Giants, about to baffle the batter with his great spitball

© Underwood and Underwood

NO definite explanation of the vagaries of the spitball or the "shine" ball has ever, so far as I am aware, been given. I have seen many generalizations, but no specific explanation, and so I am now essaying the task in the hope that it may prove interesting, and possibly serviceable, to players of baseball.

Definite and consistent curves in baseball, or swerves, as they are called in cricket, can be produced only by spin imparted to the ball by all the fingers and thumb or some of them.

Comparatively few people know that the "top" of a wheel moves more quickly through the atmosphere than the "bottom"; yet this is undoubtedly so. The reason is that at the "top" of the wheel the motions of revolution and progression "conspire" or coincide. To put it, perhaps, a little more simply we may say that the wheel is going forward and is rolling forwardly, therefore at the top we have the sum of these two motions.



The Spitball

Spin *A* to *B*. Flight *D* to *E*. Therefore spin and progression conspire at portion shaded dark, *C*. At portion *F*, the spin is against the progression. Consequently, the ball is forced towards *F'*, as there is less friction there than at *C*

It is otherwise at the bottom of the wheel. Here, as this portion of the wheel is revolving backwardly, the rotary motion conflicts with the progressive motion, and instead of the sum of two motions, we get the difference. Of course all portions of the wheel viewed as a whole are progressing towards its destination at the same rate. It is merely that certain constantly-changing portions are moving through the atmosphere at different speeds.

That, shortly, is the whole secret of curve or swerve, for the side of the ball whereon the motions conspire sets up more friction with the air than that on which they conflict. A projectile always seeks the line of least resistance, therefore the ball is forced over toward the side where the spin is backward.

I may here repeat that there is, so far as I am aware, absolutely no other means whereby definite and consistent curves with a ball can be obtained. If there be, and anyone can tell us of them, the scientific world will be much interested.

This brings us to a consideration of the spitball and the "shine" ball. Any curve that these balls have is not due to the action of the air on the wet or shiny patch on the ball.

It is due to the amount of spin that is imparted to them by the pitcher on account of those patches. What finally decides the nature of the spin on any ball must necessarily be the last point of contact between the ball and the player. If a ball is held, say, mainly by two fingers and a thumb, and pitched from that hold, the flesh grip of the three engaging members may be approximately the same, except for the force of gravity's bearing the ball down on the lowest of the three, and the push of any downward action in the throw.

Now, suppose that the portion of the ball remote, or farthest away from the lowest engaging member, naturally, in

most cases, the thumb, is touched or held on a spot that is covered with moisture or has been made smooth and shiny with some substance. It stands to reason that the ball will slide away here with less friction than where it is held with a natural flesh-grip. It follows therefore that this artificial release must have considerable influence in determining the amount of spin imparted to the ball, and it would seem a reasonable deduction that the amount of spin and consequently of curve must vary considerably to correspond with the degree of slipperiness of the patch on the ball and whether it was on top of the ball or on the bottom.

If anyone thinks that the curve or swerve in these balls is obtained from the effect of the shine or the spit, apart from the action of the spin, he may speedily disabuse his mind of the idea by putting a number of "shine" or spitballs in a driving machine, such as those used by golf-ball makers, and propelling them violently.

If, as is quite conceivable, the patches had any effect, it would not be consistent and persistent, for, if the wet retarded one side of the ball enough to be appreciable, the wet patch would speedily go behind the ball and stay there, or swing across and show on the other side, when it would produce a return swerve!

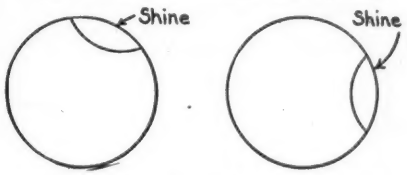
Then baseballers would in that case have a new ball, the zig-zag!

The effect, if any, on a similarly-propelled "shine" ball would probably be opposed to that of the spitball.

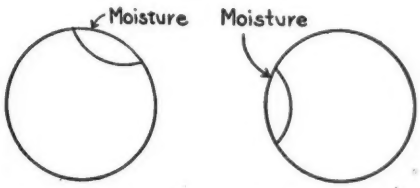
The erratic flight of these balls, and, comparatively speaking, the lack of control over them that the pitcher has, lend color to the idea that their production is, as I have indicated, largely adventitious.

Many prominent players think that any attempt artificially to alter the natural flesh-grip should be stopped by law. This must always be difficult; but if pitchers would only understand that, to a very great extent, the spitball and the "shine" ball are myths, they would do much better with a natural delivery, backed by a little more practical knowledge as to what it really is that they are trying to do; and batters would lose a bogey.

The "shine" ball and the spitball



At left: "Shine" ball leaving pitcher's hands. At right: "Shine" ball going over plate. The least resistant portion, the shiny patch, has gone to the front



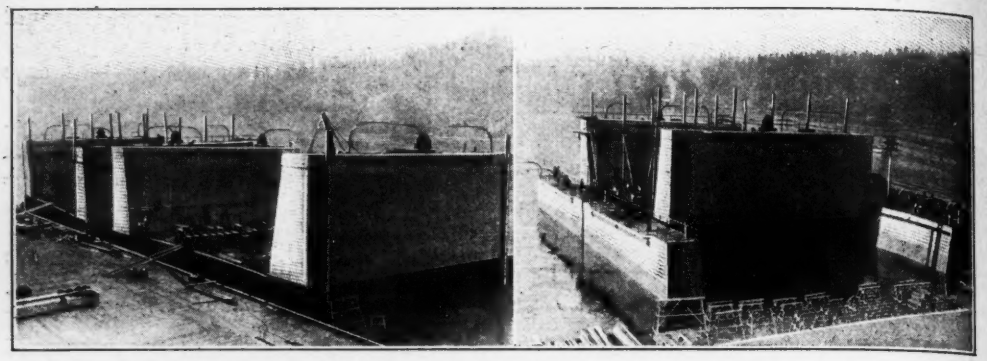
At left: Spitball leaving pitcher's hands. At right: Spitball going over plate. Moisture having gripped the atmosphere, that portion goes behind the ball during its flight, which it does not do in practical baseball

©Int. Film Serv.

Russell, of the White Sox, just after delivering a powerful "spitter"

Nerve Shock Due to Detonations Less Wearing Than War Strain

THE term shell shock has misled many persons to believe that it is due to the profound impression or shock produced on the nervous system by the detonations of high explosives. No doubt, there are cases of actual brain or nerve injury due to concussion of the air accompanying shell explosions, but these mechanical causes are a great deal less frequently responsible for war neuroses than the mental effects of general war strain. It is remarkable that these war neuroses, common as they are among privates and officers alike, are seldom found in men who have been actually wounded. Perhaps this seeming anomaly is due to the actual wound shock offsetting the mental impression affecting the controlling nerve-center in such cases.



A passenger ferryboat rammed this mammoth floating drydock in a dense fog. The damaged section promptly separated from the others, turned sidewise and floated inside its former companions

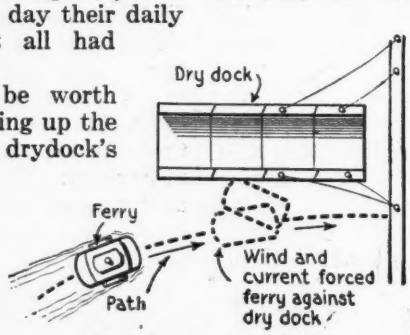
Nothing Troubles This Drydock. It Can Repair Even Itself

THE big floating drydock in the harbor of Tacoma, Washington, was rammed in a dense fog by a passenger ferryboat, and one of its four sections driven in. The ferryboat was of the old-fashioned river type with a draft of only three feet. In the winds and currents of Tacoma's open harbor it was notoriously unmanageable.

But the drydock was a match for the ferryboat. The section which the ferryboat had damaged was promptly separated from the others, turned sidewise, and floated *inside* its former companions. Men thereupon went to work with a will and elevated the damaged brother above the water's surface so that repairs could be made. And by this time all four sections are back in the water again, joined together, and doing each day their daily work as if nothing at all had happened.

Incidentally it may be worth while to note that doctoring up the damaged section was the drydock's first job, and it accordingly started a life of repairing by first repairing itself.

In the illustration above, the entire drydock is shown at the left, while at the right the damaged section is shown inside the two submerged sections of its former self, undergoing repairs. The diagram below shows how collision between drydock and ferryboat occurred.



How ferryboat hit the dock that repaired itself

Does a Locomotive Wheel Travel Slower or Faster than the Train?

IT is an interesting point to consider that on a locomotive wheel, the circumference is continually traveling at different speeds. First a point on the circumference of the wheel will go faster than the rest of the locomotive; then that same point will go slower; at still other times, the point will travel at a speed equal to that of the locomotive cabin.

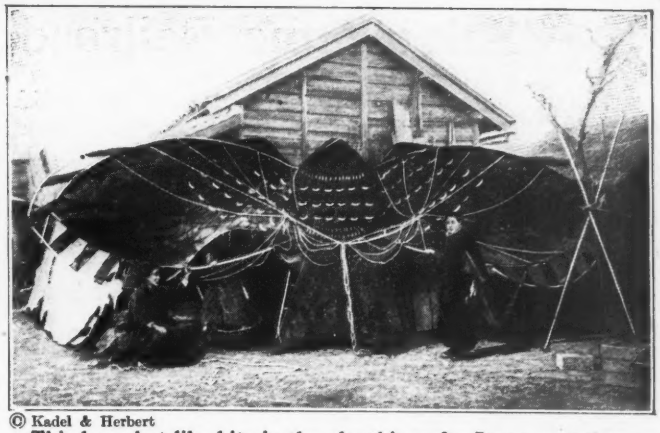
This paradox is explained by considering first the point on the circumference farthest to the rear of the wheel's center. When the center of the wheel moves forward with the same speed as the rest of the locomotive, that point will move around and in a short time it will get ahead of the center. Obviously, to do this, this point has to travel faster than the locomotive.

As the train moves on from this position, however, the average speed of that same point will become less than that of the locomotive. This is evident, since the point will soon change from a position directly in front of the wheel's center to another point directly in the rear.

This apparent paradox is not related to the old saw concerning the relative speeds of a kangaroo's hind legs and front legs when jumping Australian sand hills.

What Makes the Rumble of Thunder?

WHY does thunder rumble? The path of a lightning flash through the air may be several miles in length. All along this path the sudden expansion of the heated air—a true explosion—sets up an atmospheric wave, which spreads in all directions, and eventually registers upon our ears as thunder. Since the lightning discharge is almost instantaneous, the sound wave is produced at very nearly the same time along the whole path. But the sound wave travels slowly through the air. Its speed is approximately 1,090 feet per second. Thus the sound from the part of the lightning's path that is nearest to us reaches us first, and that from other parts of the path afterward, according to their distance. Intermittent crashes and booming effects are due chiefly to irregularities in the shape of the path.



© Kadel & Herbert

This huge bat-like kite is the plaything of a Japanese prince. His place in the world requires distinctive size even in his toys

Giant Kite for the Crown Prince of Sunny Japan

WHILE the Crown Prince of Japan was on his winter vacation at the palace of Numazu he had the huge kite, which is the subject of our illustration, made for his amusement. This monster is in the form of a bird and it measures twenty-four feet from wing-tip to wing-tip. It is capable of attaining great heights and its pull is so powerful that it can lift a man off his feet; consequently, special winding machinery is needed to control it.

What American boy would like to swap places with the heir to the Cherry-blossom Empire's throne? Step lively, boys—the line forms on the right!

Making Window-Cleaning Safe

FOR the benefit of window cleaners and painters, Paul Wolff, a Hungarian in Pittsburgh, Pa., has invented a window chair or scaffold, which rests upon the window sill, extending outward and providing the workman with a secure support. The device is so arranged that it can quickly be clamped to the window frame and just as readily removed. The window frame is firmly held between a rubber-covered hook or brace and the movable clamp, which is operated by a screw, like the movable jaw of a vise.

Chair clamped to window frame with the movable jaw of a vise

Half Million Words in English Use

THE English vocabulary has grown to great size, according to Professor Clark S. Northup, of Cornell University. "The number of words found in old English literature does not exceed thirty thousand; recent dictionaries have listed more than four hundred thousand."

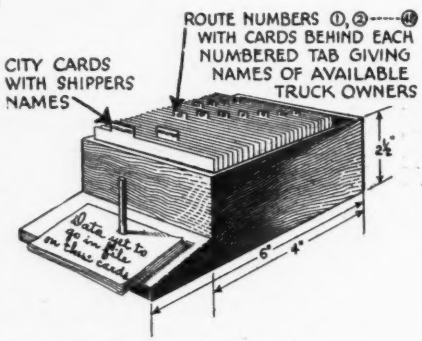
Solving the Railroad Problem

Connecticut does it by making the return trip profitable for motor trucks

LAST autumn, when the railroad congestion became acute, the State of Connecticut, which is the heart of the small arms and ammunition industry of the United States, found itself in a desperate situation. Ammunition partly finished in one plant must be hauled to other plants for different machining operations before it is completed. As there were no freight cars at all, or too few, the war material could not be moved by the railroads. Many manufacturers had to use motor trucks for that purpose, and, in some cases, even to get raw materials for their plants and to deliver finished goods to New York for shipment abroad.

The first problem was to keep the roads open. This was accomplished by taking the work of removing the snow out of the hands of the townships and turning it over to the State. The second problem was to make the haulage as economical as possible by providing return loads for the trucks.

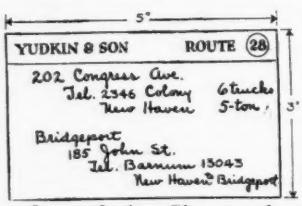
To make sure of return loads, the State, under the direction of W. S. Conning, chairman of the Motor Truck Transportation Committee of the State Council of Defense, formed Return Loads Bureaus in fourteen of the important cities of the State. Each bureau keeps a file of all the trucks available for overland haulage work. The bureau supplies information regarding trucking companies and their routes to shippers and keeps a record of all applications. This enables the bureau to post the truckmen on the prospects of obtaining a return load to their home city after they have delivered their outgoing load.



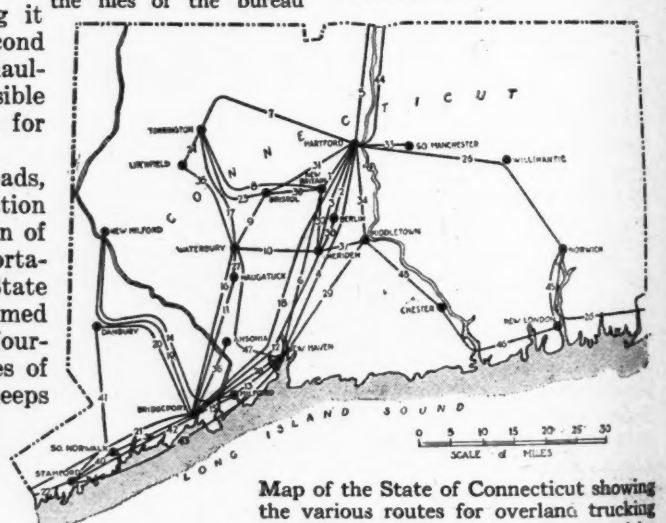
A file like this is kept in every one of the Return Loads bureaus in fourteen cities of Connecticut

The telephones of the bureaus are listed under the heading "Return Loads" to facilitate telephoning. The routes covered are numbered, and the trucks running on each route are given corresponding index numbers in the file. There are already more than seven hundred motor trucks listed under this plan and each bureau has a complete file of all available vehicles and a map of the routes covered.

Since it costs almost as much to run a truck empty as it does loaded, it will easily be seen how advantageous it is to both shipper and truckman to be sure of a return load.



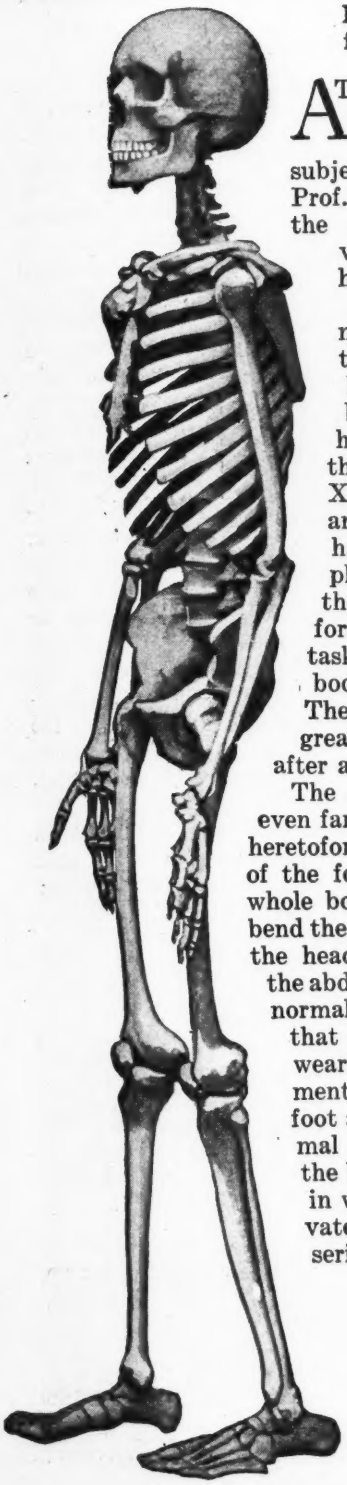
One of the City cards bearing the name of a trucking concern listed in the files of the bureau



Map of the State of Connecticut showing the various routes for overland trucking established so far in important cities

Beware of the Perils of the High Heel

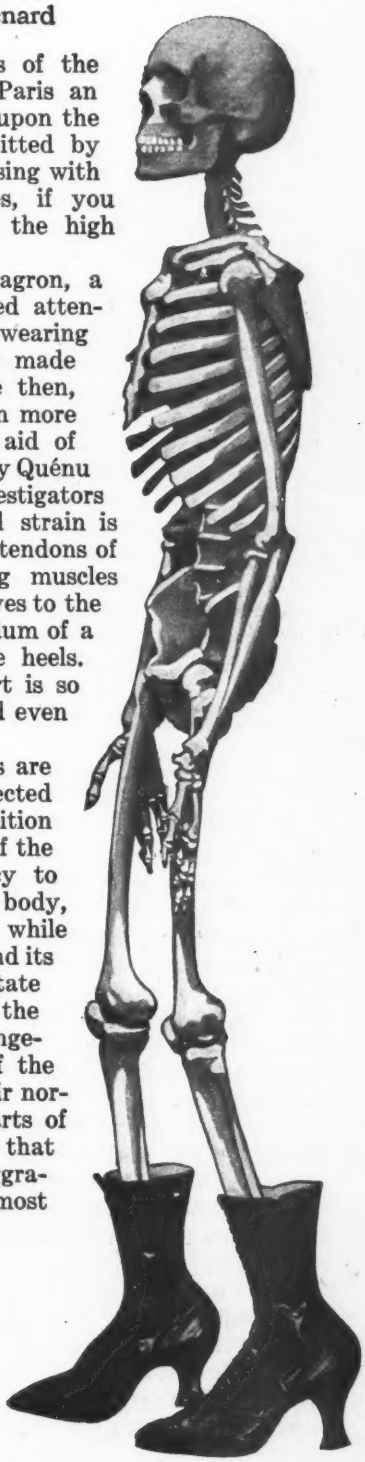
Listen to the warnings of Professor Quénu and Doctor Ménard



AT one of the recent sessions of the Academy of Medicine of Paris an interesting communication upon the subject of high heels was submitted by Prof. Quénu and Dr. Ménard, closing with the ominous warning: "Ladies, if you value your health, give up the high heels of your shoes!"

Several years ago Dr. Dagron, a noted French physician, called attention to the injurious effects of wearing high heels, but his warning made but little impression. Since then, however, the subject has been more thoroughly studied with the aid of X-Rays and moving pictures by Quénu and Ménard. These two investigators have found that an unnatural strain is placed upon the muscles and tendons of the foot, as well as upon leg muscles forced to accommodate themselves to the task of maintaining the equilibrium of a body unnaturally raised by the heels. The strain caused by this effort is so great that fatigue is experienced even after a short walk.

The effects of wearing high heels are even farther reaching than was suspected heretofore. The change of the position of the foot disturbs the equilibrium of the whole body. As there is a tendency to bend the knees the upper part of the body, the head and chest, is thrown back, while the abdomen is forced forward beyond its normal position. The physicians state that the disturbances caused by the wearing of high heels, the disarrangement of the articulated bones of the foot and the throwing out of their normal position of the different parts of the body are serious enough, but that in walking these effects are so aggravated, that they produce the most serious internal disorders.



The skeleton on the left shows the graceful poise of the normally supported body

The skeleton on the right shows how high heels change normal position of the bones

The "Little Church of the Flowers" and How It Got Its Name

THE latest thing in churches is to be found in a southern California town, in the way of growing plants.

Two rows of seats and a center aisle comprise the middle of the building. On each side beyond these seats are beautiful arches, from which large fern baskets are suspended, and beyond these arches, on both sides of the building, is a sloping roof of sky lights.

Growing plants and flowers give a peculiar charm to this little church in a southern California town

A cement walk extends between two rows of ferns, shrubs and flowering plants. In the columns are little pockets where choice begonias bloom. A similar church will be built in Los Angeles.

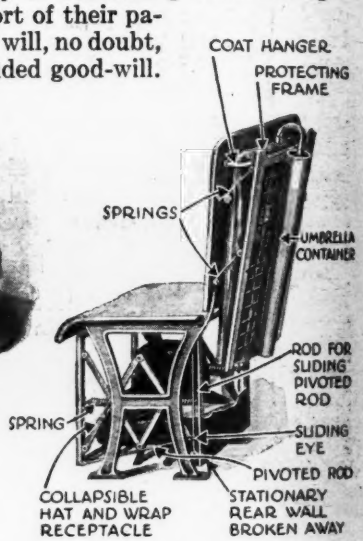
This Device Will Take Care of Your Street Clothes at the Theater

DID you ever, dear reader, have the misfortune to reserve seats at the theater and not arrive there until after the performance had started? Do you remember taking your coat off in the lobby and carrying it on your arm down to your seat? And then the wild scramble past all the other people in the row, with the resulting frenzied grabbing of hats and coats and wraps so that you would not accumulate them in your career as a snowball grows as it rolls down a hill? Do you remember the scowls and the bitten-off hasty expressions that you left in your destructive wake? If this harrowing experience has ever been yours you are going to give the inventor of a new little wardrobe your heartiest and most unqualified support. Here it is:

Imagine yourself in that man's place and you will sympathize with him

To accommodate the hat there is a sliding rack under the seat which extends and folds up on the lazy tongs principle. For the coat there is a hanger attached to the back of the seat and the coat is protected by a light framework, to which, in turn, is attached a long cylindrical receptacle for the cane or umbrella. The whole forms a remarkably compact and complete wardrobe that will accommodate all one's street clothes without the bother and inconvenience of the checkroom, with its crush and scramble and long line of waiting patrons, and, last but not least, there is no tip.

Owners of theaters might find it good policy to introduce this device in their houses, partly as an advertising novelty and partly as something contributing to the comfort of their patrons. It will, no doubt, pay in added good-will.



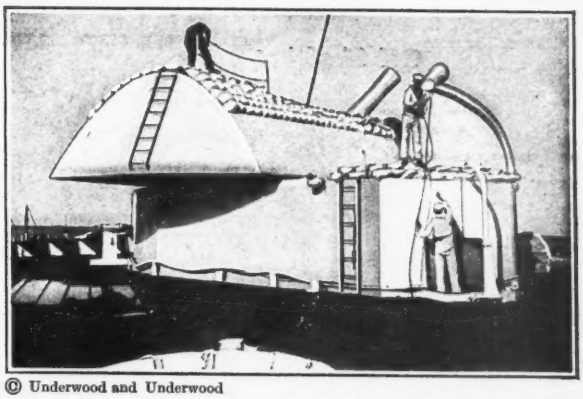
Like a modern trunk this device will hold your hat, overcoat and umbrella

A New Use for the Little Tractor: Spotting Freight Cars for Large Plants

A SMALL industrial "creeper" tractor can "spot" a carload of coal having a total weight of 45,000 pounds. The illustration proves it. One of these tractors has taken the place of a switch-engine or a gang of workmen with pinch bars for spotting or switching cars at a large industrial plant in Ohio. As the engine is railroad property, it is available only for a comparatively short time each day, while the tractor, which is always on the premises, can be utilized at all times.

The tractor does not travel on wheels, but lays its own track, and consequently can pass over obstacles and move material from one department to another without marring the surface over which it travels. The over-all width of the tractor is fifty inches and it is but two inches more in height, so that it can pass through ordinary sized factory doors easily. The tractor is used for bringing material from the factory to the shipping room or to cars that are to be loaded and for the unloading of incoming shipments, and it also transports material between the various buildings of the plant.

This little caterpillar tractor can pull without trouble a loaded car weighing 45,000 pounds, and do it easily



© Underwood and Underwood

The protective power of the armorplate of the turret is greatly enhanced by a layer of sandbags as shown

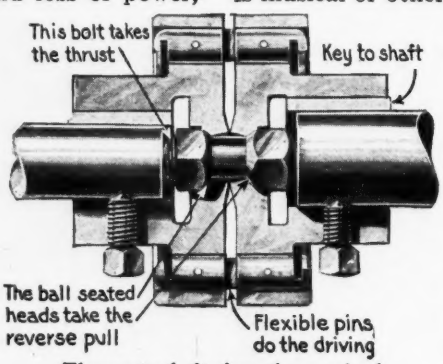
Sandbags Used as Protective Covering Even on War Ships

THE use of sandbags or wicker baskets filled with sand as a protection against hostile projectiles in warfare is by no means new, but the present war has probably seen the most extensive use ever known of this means of defence. Against the enormous force of the modern explosives neither steel nor concrete offers adequate protection. It was found that earth or sand, either in a loose state or in bags, formed a more efficient protection against shells, shrapnel or the projectiles of small arms or machine guns than barricades of other material.

The accompanying picture taken on board of a British monitor preparing to go into action shows that sandbags as a means of protection are by no means confined to the warfare in the trenches. A covering of sandbags is placed on the roof of the turret to give additional protection to the big guns and the gun crew, should they come within range of a hostile battleship, or be attacked by a hostile airplane. Without these sandbags the roof of the turret would offer little protection against missiles dropping upon them almost vertically. This applies to projectiles fired from guns with a high angle of elevation and to bombs dropped from aircraft.

Flexible Coupling Takes Side Strain Off Shafting

UNLESS there is perfect alinement of the propeller shaft with the engine or reverse-gear shaft there is sure to be trouble in any engine-propelled marine craft. Binding bearings, with resulting friction, hot journals and loss of power, or excessive vibration and consequent wear are the natural results of the side strain caused by the imperfect alinement. As a truly perfect alinement is possible only in theory, some provision must be made to compensate for defects in the alinement which may develop from various causes at any time. It was found that a flexible coupling for connecting the propeller shaft with the engine constituted the best remedy. One of these flexible couplings, which has been successfully tried for marine engines of various types, is here shown in cross section.



The center bolt gives the required rigidity to the coupling, the laminated steel pins of the flange give it the necessary flexibility

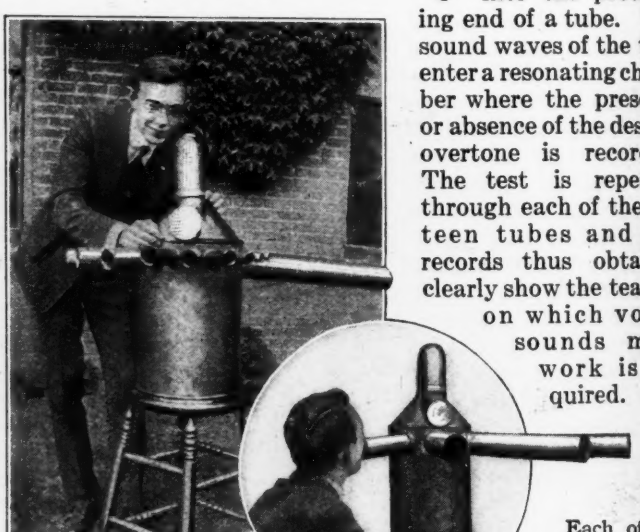
The coupling consists of two cast-iron or steel flanges connected by flexible laminated steel pins instead of rigid bolts. The construction of the coupling is made plain by the diagram. The center bolt takes the push or pull, as the case may be, from one shaft to the other. The flexible laminated steel pins, which connect the two flanges, allow sufficient play to give the coupling universal action within its intended limits. The pins take no push or pull, their business is to drive. It is expected that this arrangement will eliminate much trouble hitherto encountered.

A First Aid to the Singing-Teacher. It Analyzes the Voice

EVERY tone of the human voice is composed of fundamentals and overtones, according to the musical authorities. It is the presence or absence of the overtones which decides whether a tone is musical or otherwise. Hence overtones constitute the essentials of the singing voice.

Professor Howard H. Hanson, of San José, Calif., has perfected a device which determines what overtones of a particular voice need cultivating or subduing for the sake of bringing the voice up to its maximum beauty. The device is constructed principally of tin and resembles a huge stove-pipe joint from which tubes of various lengths and sizes protrude horizontally.

There are sixteen of the tubes, and each is tuned to a different overtone of middle "C." When a voice is to be tested, the student sings the five vowels on middle "C" into the protruding end of a tube. The sound waves of the tone enter a resonating chamber where the presence or absence of the desired overtone is recorded. The test is repeated through each of the sixteen tubes and the records thus obtained clearly show the teacher on which vowel sounds most work is required.



The student sings into the tubes to test quality of voice

Each of the tubes registers a certain overtone of middle "C"

Canned Ostrich Eggs May Find a Market in London

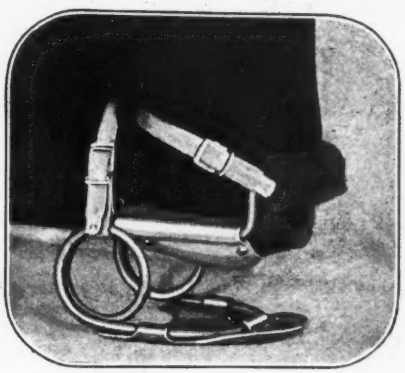
SIGNS reading "Newly canned ostrich eggs for sale" may soon meet the eyes of the housewife looking into the windows of grocery stores in London. This statement is based on the fact that ostrich eggs are being packed experimentally in South America for shipment to England in liquid form. One ostrich egg is equal to about two dozen hen's eggs. If the canning of these eggs proves successful, it will mean the salvation of the ostrich growing industry which has suffered considerably as a result of the war. It will take a large family to consume one breakfast egg.

Delightfully refreshing is a swim taken on this aquatic bicycle which has air chambers for buoying you up, a propeller for forward progress, and a rudder for turning

Kneeling in Cotton Fields Made Comfortable by This Pad

COTTON pickers have to work for hours at a time kneeling upon the damp ground. They suffer tortures. To relieve them, Robert T. Jenney and Rudolph J. Langer of Monticello, Ia., invented a knee-protector. After the invention was perfected, it became apparent that it would be equally beneficial to miners, cement workers, carpenters and gardeners.

The knee-protector is made of strong spring steel. It is just of the right height to place the foot in a restful position. The knee rests in a felt-padded hammock of leather or canvas between the upper arms of the coiled spring while to the lower arms a metal shoe is fastened which is slightly curved upwards in front. The device is fastened to the leg by two straps, one above and the other below the knee. The construction of this humanitarian device is shown in the accompanying illustration. It should prove beneficial to many workers.



The knee rests in a padded hammock of leather or canvas supported by coiled springs

Ride This New Underwater Bicycle —It's Great Sport at the Beach

AT the average bathing beach about all you can do is swim, or paddle around in an old canoe.

And so P. Kraemer of Jersey City, N. J., devised the underwater bicycle here illustrated. With this bicycle you can make as much as six or eight miles per hour, which is fast for swimming.

But do you swim on a bicycle? You do on Kraemer's, in a sense, for most of your body is submerged. The submerged feature was especially desired by the inventor. He wants you to get the full effect of the water's coolness on a hot day. The two tanks shown are of course filled with air, so as to support a rider of almost any weight. The handlebars control the rudder.

This contrivance should appeal to those for whom ordinary swimming methods are too slow. This aquatic bicycle may make the fish join the birds in wondering where man's encroachments on other domains are to end.

Home-Training for Wireless Heroes

A phonograph and book of rules will help to qualify you for a radio operator's post

THE wireless operator of the future who may, during the din of battle, receive a message that will result in victory for his country, or, from the deck of a ship, pick up an appeal that will save hundreds of lives, can prepare himself for such heroic acts by sitting in his home and listening to the records of a phonograph. And if he's a faithful student, he may be able to prepare himself for these pulse-stirring rôles in from three to four months.

At the beginning of the course the student merely listens to the dots and dashes as they issue from the machine and compares them with letters and figures in a booklet. In the first record each letter and figure is first announced orally and then signalled three times. In the second lesson he is initiated into the difficulties of punctuation and special signs, while the next step finds him struggling with sentences like this: "The quick brown fox jumped right over the lazy dog." And from this reminder of his early school days the prospective operator is called on to translate the dots and dashes of a "press" dispatch—sent just as it would come from the key of a veteran radio man at Arlington or Poldhu. Static, interference from other stations and the reception of code words are taken up in other records.

An ordinary telegraph key was used in making the records. After the student has become familiar enough with the letters to recognize them as he hears the dots and dashes, he is advised to manipulate the phonograph so that they will reach his ears in irregular sequence, in order that his skill in receiving may be tested.

The phonograph is employed for instruction in sending as well as receiving. As soon as the prospective operator has become able instantly to translate the letters as they are produced by the phonograph, he is ready to begin practice with the telegraph key. The booklet accompanying the machine gives him information regarding the position of the hand and calls attention to common faults in transmitting. Simultaneous operation of the key and listening to records will develop evenness, accuracy and speed.

Thus the student learns the preliminary essentials of how to become a wireless operator. What use he will make of the instruction will be shown when he is placed in emergencies in which men of the radio key frequently find themselves. In the course of time his ear will become as familiar with the dots and dashes of the language of the air as with ordinary speech, and his fingers will manipulate the keys almost mechanically.

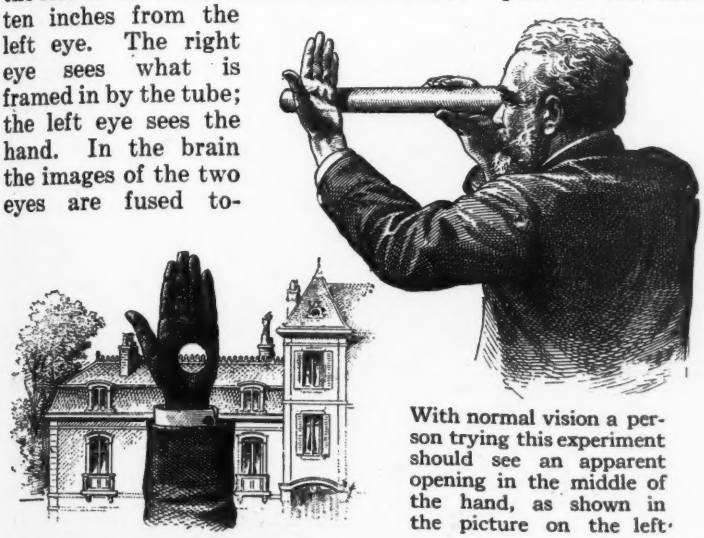
The upper picture shows the correct way of working the key. In the lower picture the student practices sending while listening to a message from phonograph

Looking Through Your Hand

An optical illusion and at the same time a valuable test

IN a recent issue of "La Nature" H. Volta speaks interestingly of an instrument which he calls "The illusion of the hole through the hand" and incidentally points out the value of that experiment as a clinical test for cross-eyes and other defects of vision.

Place before one eye, the right one, for instance, a roll of paper or a pasteboard tube; then hold the left hand, open, to the left of the tube, at a distance of about ten inches from the left eye. The right eye sees what is framed in by the tube; the left eye sees the hand. In the brain the images of the two eyes are fused together; it seems as if the left hand were perforated by a hole through which can be seen the objects included in the field of the tube. What is the explanation of this curious phenomenon?



With normal vision a person trying this experiment should see an apparent opening in the middle of the hand, as shown in the picture on the left.

When we look at an object, each eye sees it, but the impressions of the retinas are transmitted in such a way as to register but a single image in the brain. That is what the physicians express by saying that the rays emanating from the same object strike identical points of our retinas; the optical nerves leading from these points are combined so as to connect with a single brain cell. If some trouble affects one of the eyes, the points of the two retinas which have received impressions are no longer symmetrical; the two images cannot be fused into a single brain perception; we see double, a condition which is known scientifically as diplopia.

The explanation is quite simple, but, and this is the interesting feature of this experiment, one may deduct from it the most interesting clinical indications, which make it possible to combat from the start the cross-eyedness with which children are troubled so frequently and which parents too often have a tendency to neglect.

Cross-eyedness develops in children gradually—so gradually, in fact, that the eyes become accustomed to the defect and do not betray its existence by seeing double. The functions of the eye with the less perfect vision are simply neutralized. When the good eye is closed, the poor eye sees; but when the good eye is opened again the images conveyed by the poor eye are again disregarded by the brain. Although there is no double vision, binocular vision is no longer possible.

By means of the experiment described it is possible to ascertain whether correct binocular vision is possible to the person tested. With normal vision the apparent hole should be seen in the middle of the hand. If the hand or the view in the field of the tube is not seen, one of the eyes does not see at all, or its impressions are neutralized. If cross-eyedness exists, the hole will appear to the right or the left, above or below the hand. The distance at which the left hand has to be held from the end of the tube before the hole most nearly approaches its center differs according to the degree of cross-eyedness, and will furnish the eye specialist valuable information.

Photographing Holland in California

New motion picture trickery, how it is done and how pleasing the results

WHEN the legitimate stage wishes to produce a scene laid in some foreign country all it relies on is a few painted sets and appropriate furniture. In motion pictures, however, the director has to find some means of building a real duplicate.

An excellent illustration of the resourcefulness displayed in such matters is found in the construction by a film director of a Dutch village—in California! The buildings were simple enough; a rigid framework covered with *papier maché*, light plaster or even painted burlap being quite sufficient. But the canals and bridges were by no means so simply constructed. Fortunately, however, the scenario did not call for any dives or marine disasters. Hence the canal was only a foot deep—just enough to float a small boat. The sides were constructed of wood, well tarred and caulked, and the earth in the stream bed tamped solid to prevent drainage. Then began the real camouflaging.

It would never do, of course, for you to suspect that the scene was made in the studio loft, in spite of the fact that common sense would tell you that it couldn't have been made anywhere else. So the framework, as it were, had to be covered over and retouched until every detail was perfect. One of our photographs shows the result. The "bricks" on the sidewalk are thin strips of wood with loose sand sprinkled between. The tree was cut in a nearby field the day before this photograph was taken. The bridge, apparently of concrete, is simply wood covered with plaster. The flag paving on the bridge itself is merely wood grooved in irregular oblongs and squares

This picture shows how a motion picture concern built a Dutch village, canal, bridge, and houses in California. The framework is rigid, the rest mainly papier maché

It is hard to realize that this remarkably life-like Dutch village scene is all sham and deceiving trickery, built to serve only a brief while until the camera has caught it

to assume the appearance of paving stones. The roofs of the houses are made of tiling and shingles laid on loosely and easily removed. For next week this village may be in Siberia, with a roof of ice, and the canal will be the road before the dismal village inn!

What the Twenty-Dollar Gold Piece Has Been Through

THE twenty-dollar gold piece has had an interesting career. Jewelers melted it for their fine gold work, some forty years ago, and were very successful until the Government experts discovered the practice and stopped it in short order by "peppering" the gold with iridium. Following this, unscrupulous persons attempted to gather scrap gold by "sweating," or placing a number of coins in a bag and then shaking them violently, thus obtaining tiny particles of gold by friction. After these coins had been put through the "sweating" process it was an easy matter to pass them on unsuspecting tradesmen and banks, provided, of course, that the victims did not weigh the coin. The amount of gold scrap obtained by the "sweating" process was so small that the bags had to be burned to recover it.

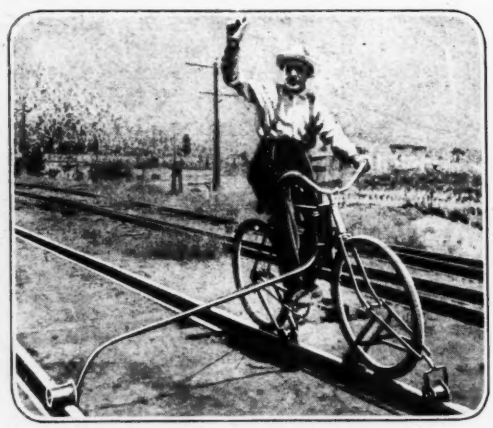
Another way was to "strip" a coin by putting it into an electro-chemical bath, getting thereby a slight residue of gold on a copper plate, which was afterward melted and the metals separated. Because this method discolored the gold it was not very popular. One of the most successful schemes, however, was the use of a specially prepared male and female die. The diameter of the die was about one one-thousandth of an inch smaller than the diameter of the coin. It was so made that after the resultant rim of metal was cut off the milled edges remained. From a single $20 coin the gold thus obtained was worth about fifty cents, and the coin, to all appearances, had not been tampered with.

Turning a Bicycle Into a Railway Hand Car

"FLAG train No. 71, southbound, before it crosses the creek and make it back into siding to let southbound Special pass." Such was the order conveyed by the ticker in the little wayside station.

"By George," exclaims the station agent, "this is an ugly fix! The creek is five miles from here and No. 71 is due here in half an hour."

"Look here, Jim," interrupts his friend Harry; "Tony is sick and will lend me that outfit of his. I can hit it up some and make the trip easily!"



A few turns of the hand turned this bicycle into a speedy railway hand car

Jim eagerly approves of the plan. Tony consented to the loan and Harry "hit it up" so thoroughly, that he reached the creek long before No. 71 came in sight. The danger of a collision was averted.

Tony's "outfit" was merely a bicycle equipped with an attachment invented by Agostino Rea, of Helper, Utah, which makes it possible to run the bicycle on railroad tracks. The device is simple of construction and inexpensive. Attached to the axles of the wheels of the bicycle are forked arms provided with grooved trolley wheels at their free ends. These forks can be swung down so that the trolley wheels engage the rail and prevent the wheels of the bicycle from leaving the track. A long arm, with a roller at the free end, is attached to the frame of the bicycle. When in use, the roller runs on the other rail of the track and acts as a brace to maintain the balance of the wheel. When not needed, the arms with the trolley wheels and the balancing arm may be swung out of the way and fastened.

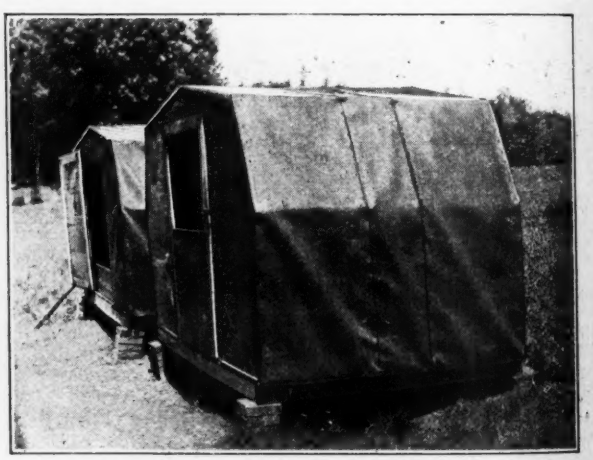
Making a Wind-Proof, Rain-Proof Chicken House from Piano Boxes

WHEN the United States Department of Agriculture is urging that every back-yard be the home for a flock of chickens, an inexpensive and novel plan of converting two piano boxes into a poultry house becomes at once practical and advisable.

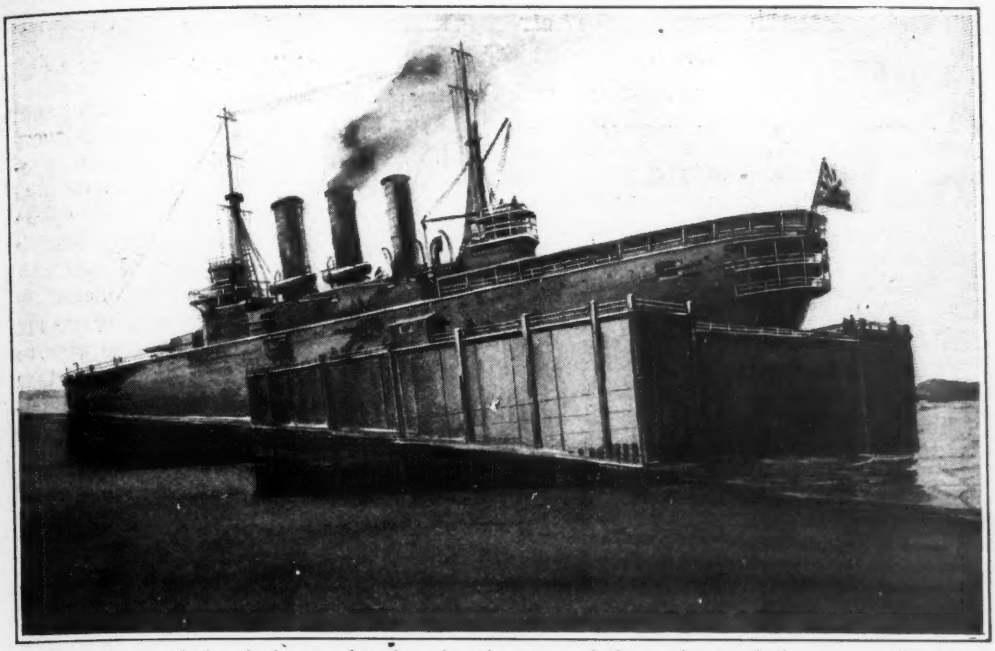
The two boxes are placed back to back, three feet apart, the back and top of each removed, a frame for roof and floor added, and the part between the boxes built in with boards removed from the two boxes. The house is covered with roofing paper which will keep out wind and rain. The piano boxes can be purchased for $2.50 each. The complete home for the poultry can be built quickly and easily for $12. It will comfortably house a dozen hens.

The rear window provides ventilation and insures coolness in warm weather. Windows can be used instead of solid shutters so that the houses will be lighter when closed.

A door can be cut at the end, covered with muslin to insure good ventilation.



To insure dryness the boxes should rest on brick supports and be surrounded by drainage gutters



The submerged dry dock was placed under the stern of the cruiser and then pumped out, thereby lifting the stern out of the water. This remarkable feat took place at Honolulu

A Four-Hundred-Foot Ship in a Three-Hundred-Foot Dock

THE unusual feat of dry-docking a ship of four hundred and forty-six feet in length and a displacement of 9,300 tons in a dry dock only three hundred feet long and with a lifting capacity of 4,500 tons, was accomplished a short time ago, when the Japanese first-class cruiser *Azuma*, the propeller of which had been damaged, was docked for repairs in a floating dry dock at Honolulu. In order to carry out this undertaking, the dock was submerged and placed under the stern of the cruiser and then pumped out. It is said to have been the first time that this seemingly impossible feat was attempted. The result was extremely gratifying, and the remarkable procedure is sure to find imitators elsewhere.

Thirty Million Collisions in a Day—the Earth's Record

ASTRONOMERS have collected a great deal of material in recent years which seems to prove that there is an enormous mass of non-luminous comet or meteorite material scattered through stellar space. It is estimated that as many as twenty or thirty millions of such bodies collide with the earth every twenty-four hours. Assuming a fairly even distribution of these cosmic particles in space, their quantity and number must be beyond computation. Clouds of such particles are now believed to be the cause of the dark and starless areas in regions where bright stars are numerous. It is assumed that clouds of meteorite material prevent us from seeing the stars beyond in these particular regions of space. The dark spaces in the Milky Way, the so-called "coal sacks" in the constellation of Sagittarius and many other starless regions are accounted for in this manner.

Photographic star records made at Harvard and elsewhere during recent years have supplied much valuable information to support the theory that the so-called new stars, also known as temporary stars, which flash out at points where previously no stars were known to exist, are stars which suddenly become luminous by passing through a cloud of meteoric particles. While passing through the cloud the faintly luminous star is in effect bombarded at high velocity by the meteoric cloud. The surface strata become heated and the luminosity of the star increases rapidly.

How the French Developed Their Newest Type of Battleplane

FOR a long time the principal French reconnoitering and bombing airplanes were only slight modifications of the early Henry Farman type, well known in America. That airplane was stripped down to the last essentials: ailerons, elevator, rudder and a simple four-wheeled landing gear with rubber shock-absorbers (then a novelty). The pilot was perched on the front edge of the lower plane. A large fuel tank formed the back of his seat; directly behind it was the Gnome motor with a big, low-pitched pusher-propeller. That arrangement made a fuselage or hull impracticable. The big, double-control surfaces had to be carried by a wide open "cage" of poles (at first of bamboo) and wires. Farman was not a scientist, not an engineer, not an inventor, but a bicycle rider who knew what was practical in flying.

When the war began, Farman's homely type of airplane ousted the complicated Breguet biplanes and all the monoplanes because of its dependability. It was not improved much—simply given stronger, better engines, simpler control surfaces, some streamlining and an enclosed body for the aviator. All this was, of course, not sufficient to permit the development of modern speeds.

From the very beginning the French also had some Caudrons, large biplanes, from which the modern type of speed airplanes was developed. In these machines the body was turned into a fuselage because there were twin motors and propellers out on the planes. A central fuselage offered, therefore, the simplest mounting for rudder, elevator and stabilizers. This developed in it the germ of a speed machine. Thus it came about that the Caudron forged ahead more and more, as the science of aviation progressed and developed.

The accompanying illustration shows one of the latest developments of this type, a true, up-to-date speed machine. Streamlining is proclaimed paramount by the form of the engine housings which are so arranged that they permit the wind to reach and cool the machinery. Other obvious proofs of minimum head resistance are the characteristic nose of the fuselage, the remarkably slender struts and staywires made vibrationless by holding two parallel wires against an intermediate piece of wood.

Appropriately Enough—A Band of Brigands Were the First "Chauffeurs"

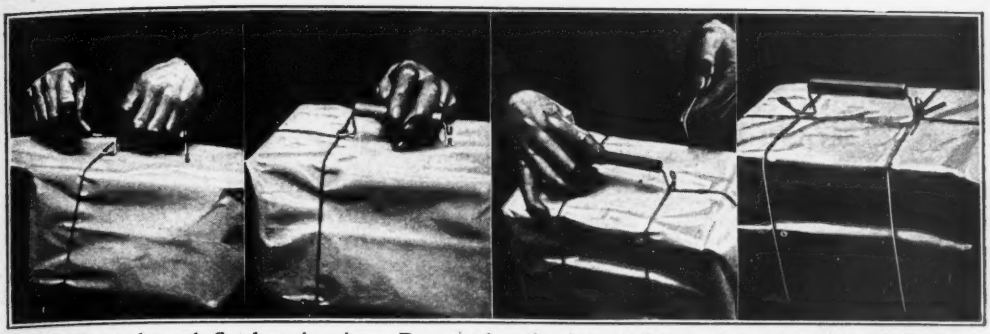
HERE is a justification for a bit of our American slang. It seems that the word chauffeur means "scorcher."

Over a century ago, some particularly brigandish brigands lived on the borderland between France and Germany. To force ransoms from their captives, these desperadoes grilled the soles of their victims' feet before a fierce fire. So the countryfolk referred to the band as scorchers or, in French, *chauffeurs.*

Not so many years back, when these same imaginative French were in need of a descriptive name for motor-car drivers, they hit upon the word chauffeur. Just how much "scorching" of a more modern kind these up-to-date brigands of the road indulge in is best divulged by police records of fines for speeding.

© Int. Film Serv.

This latest type airplane, intended for reconnoitering duty in the Marne sector, is just put together by expert workmen back of the French lines. It is built for speed



Slip knot through flat loop in wire. Pass cord again through loop and around ends. Bring it around and over other loop. Then the final lap and you simply slip it into the clip to hold it

A Package Handle That Saves Your Time and Cord

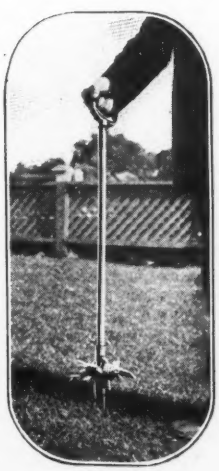
A COMBINED package carrier and tier invented by Friedrich O. Vontobel, a Swiss resident of New York, promises to be of considerable interest.

The pictures clearly illustrate the construction of the device and its application. At one end there is a flat loop of wire in the same direction as the handle, at the other end a flat loop at right angles to the direction of the handle with another bend at right angles to it near the middle of the loop.

This device saves time and cord. Before the tying is begun a knot has to be made in the end of the cord used for tying. No other knots are required.

The New Dandelion Extractor. You Can Work It Without Stooping

A NEW device for pulling dandelions has been invented by Hans C. Johnson, of Fort Bragg, California. It has a curved scoop for penetrating the earth adjacent to the plant. Pivotally attached to the shank of the scoop and opposed to it is a small toothed digger, which, when it is swung to closed position, impales or binds the plant against the scoop so that it can be readily extracted from the earth. This digger is linked to a slidable rod contained within the main stem of the implement. Two handles are provided, one for the main stem and one for the slidable rod. When the two are grasped and closed together the rod is pulled upward, causing the digger to swing toward the scoop to engage the plant. It will be observed that the person using this device does not have to stoop to conquer. Incidentally it is a fine weapon for attacking weeds on the lawn.



Without stooping, it is possible to "spot" every weed and uproot it with this new extractor

Fasting Is Not What It's Cracked Up to Be, Experiments Show

IT is impossible to stop eating and not feel the pangs of hunger. If you have been led to believe differently by the stories of men who have undergone fasting tests listen to the words of Professor Carlson of the University of Chicago. He found as a result of observation on man during prolonged intentional starvation, that the view that hunger mechanism fails early does not hold as a general rule. The professional faster, he points out, may ignore the pangs of hunger in a spirit of bravado.

Indian fakirs who have been practising the trick of fasting until the normal cravings of the body have submitted to will-power, are said to be able to go without food for incredible periods of time. But probably the real truth of the matter is known only to them.

The fumes of the volatile liquid are forced into the openings of the tunnels and kill every ground squirrel in them

Making a Gas Attack on the Pesky Ground Squirrel

FULLY a score of men, each carrying a mysterious long-handled container resembling a churn with an end of hose attached, have reached the field. They do not march in close formation, but scatter in every direction, apparently in search of something. First one then another stops, puts down his churn, fumbles with the hose and then grips the handle of his churn and begins to work it up and down like the handle of a bicycle pump. What are these men doing and why are they doing it? Is this war?—Yes, it is war—not against a nation, however, but against the ground squirrel, feared because of its destructiveness and because it is known to be a carrier of the germs of the bubonic plague and other diseases.

Under the direction of the United States Public Health Service these men are sent out to exterminate the ground squirrels by pumping the fumes of carbon disulphide, a highly volatile and inflammable liquid, into the tunnels dug by the squirrels.

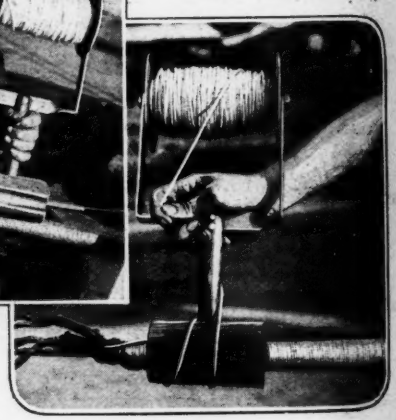
Saving Time in Insulating Electric Cables

EVERY motion picture studio uses hundreds of yards of electric cable. It is important that the cable shall not be damaged when it is walked on or when a truck should run over it. Electric cables are therefore wrapped to protect them—an expensive business. To simplify and cheapen the process, William T. Kearns, mechanical superintendent of the Balboa Motion Picture Company, has invented a clever device.

Kearn's invention consists of a reel attachment for a serving marlin. A reel of twine is held in a metal frame and the twine is wound off the reel around a marlin onto the cable. The marlin is nothing more than a wooden mallet grooved to fit against the cable, and the frame holding the spool of twine is fastened upon the handle of this marlin. The device makes it possible to bind the twine tightly on the cable.

The device saves labor. In the older and more tedious method, one man did the wrapping while another passed the twine around the cable. With this device one man does both.

This picture shows how the new serving reel is used for winding a cable by one man



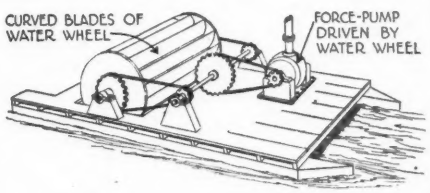
The inventor shows the old serving mallet and his improved substitute for same

Making Water Pump Itself

A novel water wheel obtains its motive power from the current

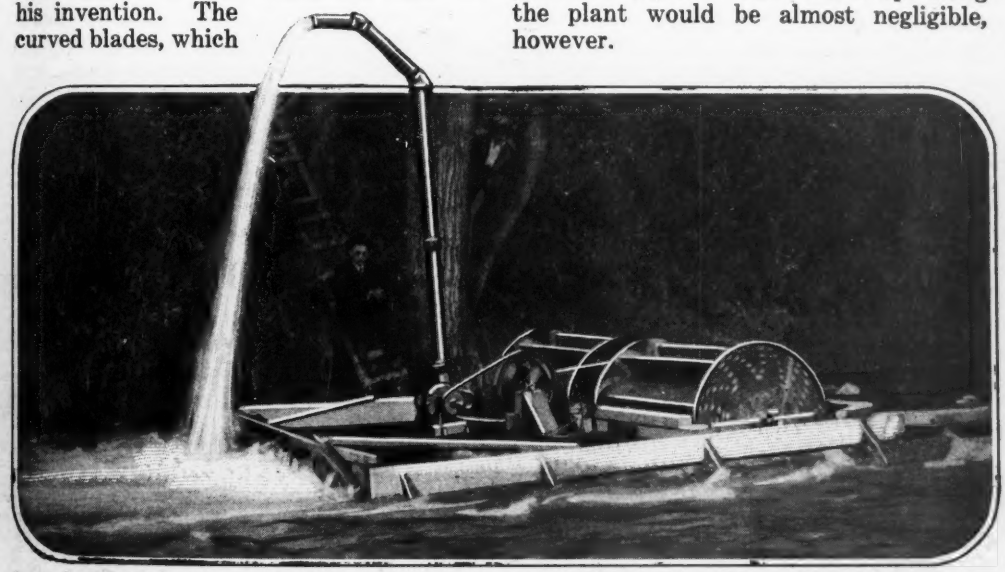
A CURRENT power wheel for raising water from running streams, which is said to be both efficient and inexpensive in operation, has been invented by H. C. Berry, of Portland, Ore., and has been successfully tested. The wheel is primarily intended for irrigation in the arid districts along the swift-flowing streams of the West.

Water wheels of many different designs have been invented and many of them have been tested by the experts of the Department of Agriculture. Their high cost or practical defects prevented their coming into general use. Realizing that the key to the effectiveness of the power plant is in the wheel itself and depends upon the size, form, arrangement, number and depth of the blades, Mr. Berry made a thorough study of the subject and many experiments before he decided upon the particular construction of the wheel he uses in his invention. The curved blades, which are shown in the illustration, are the important feature of the wheel. Each blade is removable and independent of the others,—a great advantage when repairs are necessary.



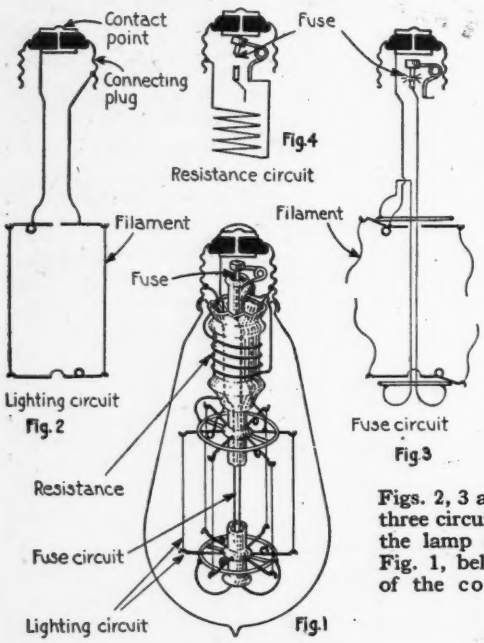
Power is transmitted from the water wheel to the pump by chain gearing

The shaft of the wheel revolves in bearings resting upon the framework of the pontoon float, which carries, besides the undershot wheel, a force pump, driven from the water wheel by a sprocket chain gearing. With a current velocity of only four miles an hour, two six-foot wheels, each forty-four inches in diameter, developed two and one-half horse-power, enough to raise two hundred gallons of water a minute to a height of twenty feet. Successful tests have been made in the shallow Clackamas River in Oregon. Tests on a larger scale are soon to be made. The cost of a plant that will develop about 100 to 115 horse-power in a ten-mile current, is estimated at from $2,000 to $3,000. The cost of operating the plant would be almost negligible, however.



A current flowing at but four miles an hour will raise 200 gallons of water a minute to height of twenty feet. Two and one-half horse-power was developed in a recent test

Which Is the "Dead" Lamp on a Series Circuit? An Automatic Cut-Out Tells



Figs. 2, 3 and 4 show the three circuits embodied in the lamp separately and Fig. 1, below, a diagram of the complete lamp

WHEN an incandescent lamp which forms part of a series circuit burns out or when its filament breaks, all other lamps on that circuit are extinguished. The circuit must be bridged around the defective lamp. As all the lamps of the circuit are extinguished, it is a tedious task to find the exact lamp which caused the break. Each one has to be tested separately until the burnt-out bulb has been found. Not until then can the circuit be restored, either by substituting a good lamp for the one burnt out or by bridging over the gap in the circuit.

The incandescent lamp recently invented by F. Wybaillie, of New York, and shown in the accompanying illustration, aims to overcome these difficulties by providing a device which automatically cuts the filament of a "dead" lamp out of the circuit and places a resistance in the circuit so as to maintain it closed and balanced. Thus the remaining lamps in the circuit are enabled to glow on.

The inventor winds a resistance coil around a resistance carrier within the lamp in such a manner that the breaking or burning out of the filament will blow out a fuse. The spring held by the fuse is released, thus introducing the resistance in the circuit and bridging over the gap caused by the burning out of the filament. The trouble and inconvenience formerly caused by the burning out of a single filament in a circuit can thus be reduced to a bagatelle.

The Fifty-Seventh Variety of Armor for the Modern Soldier Appears

THE soldiers of old went forth to fight clad in cumbersome and expensive armor, which, while serving as a protection, nevertheless hindered them from putting forth their best fighting strength. To-day, Martin Jelalian, an inventor of Rhode Island, has made it possible for a soldier to be protected by armor. He is one of several dozen inventors who have reinvented the coat of mail.

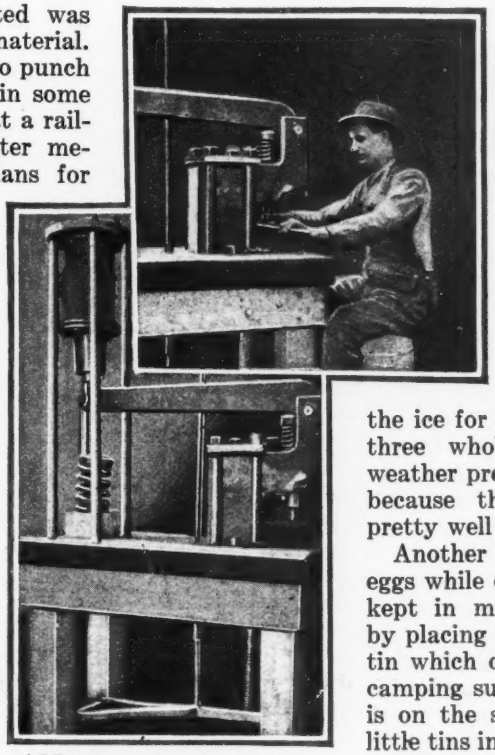
The device is a bullet-proof metallic structure which surrounds the body and extends from the top of the shoulders to below the thighs. This steel coat consists of two like parts held together across the chest by means of straps. Hooks attach the coat to semi-cylindrical pieces of metal which fit closely about the upper part of the leg, and are fastened behind by straps. The inner surface of the armor is padded. The head is protected by a lined mask composed of the same metal.

Clad in such armor our soldiers would indeed look like Martians or super-men

FOR PRACTICAL WORKERS

How to Make an Air Operated Metal Punch for the Shop

THE junk pile around a shop usually affords parts that may be of use from time to time. The punch here illustrated was made from such material. As it was necessary to punch a great many holes in some braces used in cars at a railroad shop, the master mechanic made up plans for using an old 8-in. brake cylinder for the power which was taken from a wrecked freight car. This cylinder was operated on about 100 lb. pressure, and its power, applied through levers, punched holes 9/16 in. in diameter in rough stock ½ in. thick. The controlling mechanism was made from a globe valve, changed to act like a whistle valve, the connections being made to a pedal.



Metal punch operated by an air brake cylinder

Keeping Foods and Eggs Fresh on Camping Trips

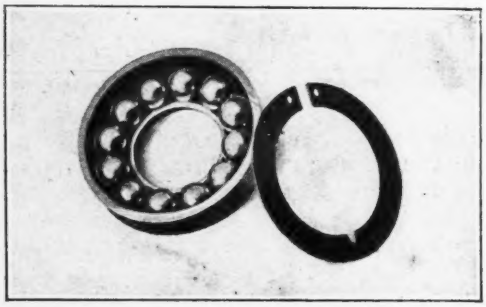
HAVING a touring car rigged out for camping, it became a problem how to keep butter and meat fresh. This problem was very satisfactorily solved by taking a single fireless cooker and clamping it to the running board of the car. A hole was bored in the bottom through to the inside and a brass tube placed in it, care being taken to solder the tube to the zinc lining of the fireless cooker. Then a hole was bored in the running board of the car to run the tube through. A wire rack was then made which came half way up the fireless cooker. Ice was put in at the bottom, then the rack and then on top of that the stuff to keep.

In one trip this improvised refrigerator was so efficient that it kept the ice for three whole days and three whole nights with the weather pretty warm. This was because the fireless cooker is pretty well insulated.

Another little trick is to keep eggs while camping. These were kept in mighty good condition by placing them in a friction top tin which can be obtained at all camping supply stores. This tin is on the same principle as the little tins in which you find spices and other commodities. First the tin was partly filled with ground cork. The cork, the kind in which grapes are packed, can be procured at fruit stores. Each egg is put in separately so that one will not touch another and surrounded by cork. Each tin will hold 14 eggs. These tins can be packed closely in a box and there need be no fear of breakage as the cork will absorb all blows and shocks.

Automobile Bearings and How to Care for Them Properly

THE bearings of the automobile are, to many motorists, as a closed book, into which they have never ventured to peep—they have been content to



The usual type of ball race with the ball holding ring and steel balls in place

let the garage man "turn the trick." In a way this may be a wise course, but, after all, it is more satisfactory for the motorist to learn and know his own car than to motor in a depend-on-someone-else manner. The bearings constitute one of the most important features of the motor car and for this reason, if he is thoroughly to know his machine, the motorist must give some attention to the bearings.

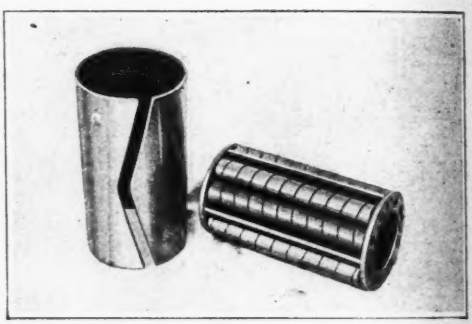
The bearings with which the modern automobile is equipped may be divided into three different classes—plain, roller and ball, the names themselves describing the types with considerable accuracy.

Plain bearings—The plain bearing consists of a cylinder which is open at both ends and split down the sides. Generally it is made of bronze and has a babbitt, a soft metal lining, this being situated immediately against the rotating shaft. The babbitt and its supporting metal are securely locked together, and as a rule there are grooves, running crosswise of the bearing or at an angle, cut in the babbitt to permit of even distribution of oil. These bearings are used as supports for the crankshaft of the engine and also for the lower ends of the connecting rods —where they connect with the crankshaft.

There is also another type of plain bearing, consisting of a bronze cylinder, without the babbitt lining, these usually being called bronze bushings. These are found at the top of the connecting rods, in the clutch, on the brake pedals, etc., or any other place where there is little danger of excessive heat being generated.

When the babbitted plain bearing becomes worn, the result is generally a knock within the motor. When this occurs it may be remedied by removing a shim, a very thin piece of metal located between the two halves of the bearing, or filing away part of the metal where the two halves touch. A laminated shim is made consisting of many thin steel layers and by removing one or more of these the offending looseness or play may be taken up. This babbitt-lined bearing requires perfect lubrication, for if the bearing is permitted to run dry excessive heat is generated through friction and the soft metal is quickly melted, or burned out, this being denoted by a pounding in the motor. The burnt-out or worn bearing should be replaced or repaired at the earliest possible moment, otherwise a ruined engine may result.

Roller bearings—These are cylindrical in form and vary in length. Each consists of a series of steel rollers which form this cylinder, and is divided into two main divisions—straight roller and tapered roller. There are radial roller bearings and thrust roller bearings and combinations of the two. These are generally

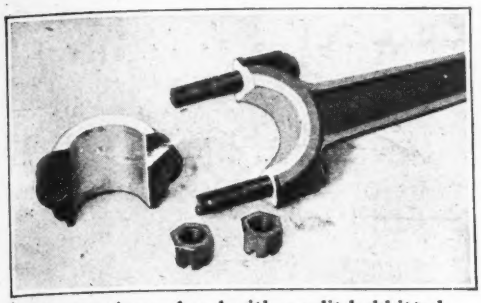


A roller bearing and its sleeve which is used on larger and longer shaft surfaces

used in the rear axle and rear wheels of the automobile. If one roller should become worn an entirely new bearing should be installed, for if all the rollers are not the same size the accuracy of the complete part cannot be maintained.

Ball bearing—This consists of steel balls which revolve between two holders or races. This is the most flexible bearing

known, and it consumes very little of the power passing through it. The ball bearing is divided into several classes. There is the annular ball bearing, which has races in the form of rings, and there is also the bearing which has a holder or race "L" shape, with curved sides facing the balls. This is known as the cup and cone



Connecting rod end with a split babbitted bearing that can be readily replaced

bearing, and these are adjustable, while the annular bearings are not. This type of bearing is also classified according to the way in which it carries its load, as thrust or radial. Ball bearings are built which withstand both radial and thrust load. Then again, bearings of this character are built which have two rows of balls. To work properly these balls must not vary in size more than one ten-thousandth of an inch. If one ball is worn through under-lubrication all of the balls of the set should be replaced with new ones. While oil is used to lubricate the plain bearing, medium weight cup grease should be used for the ball and roller bearings, and the best grade of grease is none too good.

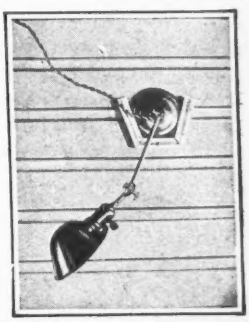
Every time the bearing is removed from the car it should be washed thoroughly in kerosene and dried on a clean, dry rag. The bearing should be kept free from water, dirt, grit, or other foreign substance, any of which might be sufficient to ruin the entire bearing assembly. Before replacing the bearing, after it is washed, fill it with new, clean grease. Caution should be exercised in tightening the bearing in its housing. See that the nuts are turned down evenly so as not to cramp the bearing in any way. The operator should never hurry in replacing the bearing. He should see that every step in the work is done right before proceeding.

Strengthening Hammer Handles with Steel Strips

A CLAW hammer of the usual kind with a wood handle may be made very strong for heavy work, such as pulling very large nails. This can be done by sawing out an opening in the handle from the hammer head back past the center of the handle an inch or two and inserting a strip of very narrow old steel buggy tire and securing in place by drilling small holes through both handle and buggy tire strip. The proper place for the holes is just back of the hammer head, one in the center, and one just back of the center an inch or two from the end of the buggy tire strip. Sometimes the drilling may be dispensed with by selecting a strip of buggy tire with bolt holes in the proper places.

A Wall Hanger for the Ordinary Electric Lamp Stand

THE illustration shows a simple device for using an adjustable electric stand lamp as a wall lamp at the head of bed or couch. The device consists of three strips of wood screwed to the wall in the shape of a half hexagon and three narrower strips nailed on to them so as to extend over the inner edge, forming a groove into which the base of the lamp can be inserted and held firmly. Being adjustable, the lamp affords a reading light at whatever angle the person reclining on the couch desires.—F. L. CLARK.



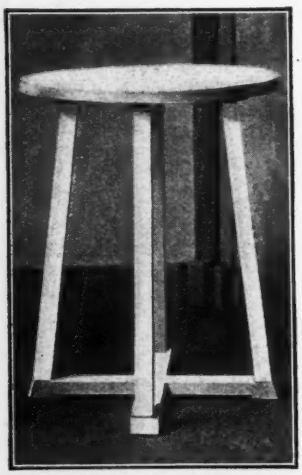
The desk lamp as it hangs on the wall

An Inexpensive and Effective Aluminum Polish

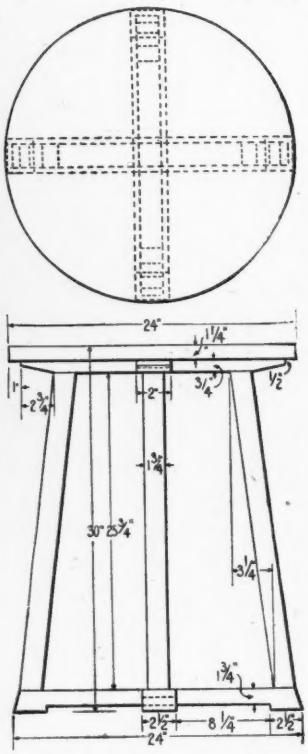
THE following is a fine polish for aluminum ware. It is made by mixing ammonia and water in equal quantities, and then adding the mixture to sufficient borax to make a paste about as thick as paint. Apply with a thick soft cloth and polish with canton flannel.

Constructing a Convenient Table for the Porch

PORCH furniture to be worthy of a place on the bungalow porch should possess individuality of type. The table described here is different from the conventional porch table and has a distinction of its own. The following bill of material gives the required pieces in lengths to make a cutting fit.



Pleasing design of a porch table that can be made of any sound wood and coated with white enamel



Details of the parts for making the porch table in a convenient size

4 legs 27 in. long by 2 in. square.
2 lower pieces 25 in. long, 2¾ in. wide and 2 in. thick.
2 cross-pieces 22½ in. long by 2¼ in. wide and 1¼ in. thick.
4 top pieces 25 in. long by 6½ in. wide and 1⅜ in. thick.
12 ½-in dowels 3 in long.
4 No. 8 flat head screws 1 in. long.
8 No. 14 flat head screws 2½ in long.
4 No. 12 flat head screws 2 in. long with washers.
4 casters.
Small quantity of 2½ in. finishing nails.

Saw out the two lower cross-pieces first and fit them together in the center with a cross lap joint, fastening them with two No. 10 screws. Next proceed to cut out the legs by squaring them up to size and cutting the ends to the correct angle. This can be found by drawing the table full size on a piece of wrapping paper and then obtaining the angle with a bevel.

The top pieces should also be cut and fitted together with a cross lap joint. Fasten these together with the two No. 8 flat head screws. It is best to glue the top up, using about four pieces to overcome any tendency to warping. Join the edges with glue and dowels, using about four dowels to each joint. While the glue in the top is drying, assemble the supporting part. Bore ¼-in. holes in the top and bottom cross-pieces where the legs are to be fastened, and countersink the holes. Before fastening the legs with screws nail them in place with the finishing nails and then insert the screws. Draw the screws up as tight as possible, and the table parts will be held together solidly.

The top should be planed and then scraped and cut out to size on a band-saw. Smooth up the edges and surfaces carefully with sandpaper. The top is then fastened to the table with screws run up through the cross-pieces. The holes for the screws had better be slotted and a washer put under the screw heads so that the top can shrink and expand readily. After the entire surfaces of all parts have been well smoothed with sandpaper it is ready for finishing. White enamel makes a very fine finish for porch furniture. It is applied as follows: First put on two coats as a base, allowing time for drying thoroughly between coats; then apply the finishing coat. Allow three days for the last coat to dry. Then the table is ready for use on the porch. As the wood used in its construction may be of any soft variety it is not difficult to make and join the parts snugly together so that there will be no seam to show after the surface is coated with the enamel. The same table can be made in quartered oak and stained to match furniture for a room, or constructed of mahogany or birch stained mahogany and used with other furniture to match for the home. The design is such that it will adapt itself for use in either case.—HARRY W. ANDERSON.

A Garden Barbecue

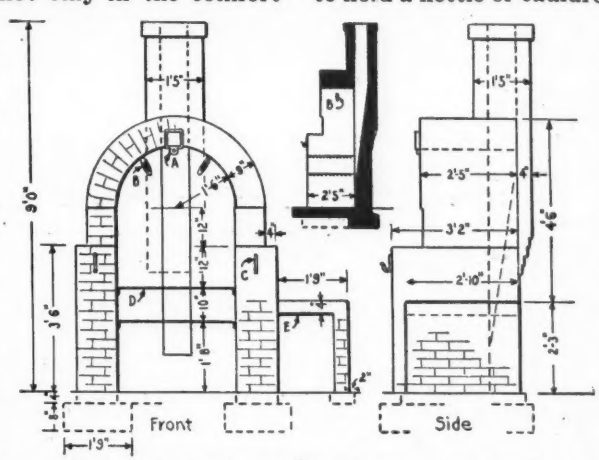
An outside fireplace with the added feature of grids for grilling fresh meat

By Huntington Baker

THE out-of-door fireplace has become a popular feature with many of the more luxurious dwellings of the West. This is usually designed to form a part of the terrace or veranda of the house, and its purpose is manifestly to combine the cheer and comfort of the open fire with the fresh, free air of the outside. Where the grounds are extensive or secluded enough to permit it, a somewhat different style of open-air fireplace has been designed, to be built generally in a clearing, apart from any building. The charm of this feature lies not only in the comfort accorded those who gather round, but in the fact of its being so constructed as to provide also, every detail necessary for the preparation of a steaming-hot meal. The garden barbecue may be built of stone, brick or concrete, and is adaptable to slightly different forms of ornamentation.

The open-air fireplace on the grounds of an estate where barbecues may be held and refreshments served

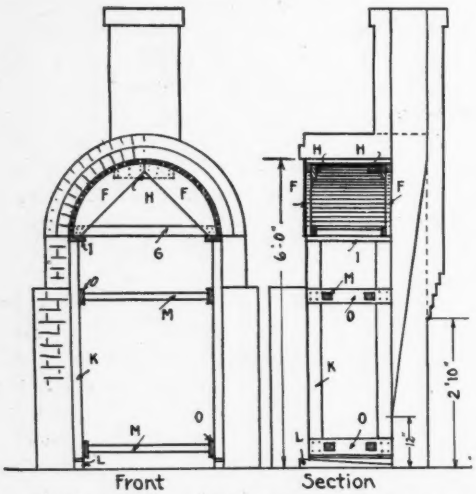
The accompanying measured drawings have been made from a typical brick example now standing in the grounds of a western country estate. This model is a practical one, not too expensive, and comparatively simple in construction. It requires about 1,700 bricks, with 3 bu. hydrated lime and 1 cu. yd. of sand for the mortar. The fittings may be secured from a blacksmith. At *A* is a wrought iron collar-strap 3/16 in. by ¾ in. made to fit around the keystone which projects to receive it. At *B* are two ½-in. eye-bars anchored to the soffit of the arch, which form, with the collar-strap, loops from which may be suspended wires or chains to hold a kettle or cauldron. At *C* are two iron hooks built into the joints of the brickwork for supporting the ends of an iron rod placed across the opening to serve as a spit or as rests for the ends of long forks or prongs thrust into the fire. At *D* are shown two shelves or grids made from corrugated wire mesh set into a frame which fits snugly into the grate on angle-brackets. These grids are removable and serve also for use in the smoking and



Plans of the fireplace giving dimensions of a good size to cook food sufficient for any entertainment

grilling of fresh meats. Attached to the main body of the barbecue is a shelter for fuel. At *E*, sheet-iron strips are used to support the bricks of the roof.

To one who has a general knowledge of brick-laying, the making of such a barbecue is no great task. Special care should be taken with the semicircular arch which is turned on a wooden templet or centering, shown in the diagram. The faces of the centering are composed of two pieces of 1¼-in. planking, sawed to the proper arcs as at *F* and braced at the bottom with ties, *G*, and at the top with fish-plates, *H*. Across the face pieces are nailed lagging-strips 1¼ in. thick by 2 in. wide and 2 ft. 5 in. long. The face pieces rest on caps *I*, under which the supports, *K*, are placed. The centering must be made shorter than the actual height of the opening to allow its base to rest on two slip wedges, *L*, which are loosened after the masonry has set, thus allowing the arch to settle down gradually to its own bearing. The wedges when withdrawn also allow for removal of the centering without injury to the bricks. The braces, *M*, are inserted between the cleats, *O*, to hold the supports in a vertical position against the jambs of the opening. The chimney is corbelled out in the rear so as to allow the flue to start at a lower level, thus making the draft more efficient. Of course the height of the chimney is variable, according to conditions, but 9 ft. is a good height for ordinary circumstances. A brick hearth in front of the fireplace is an added convenience.



Skeleton framework for building the bricks over in making the barbecue fireplace

Such a fireplace can be built in a wall on the back yard of a lot or where the grounds are small and form a part of a garden bric-a-brac. In this instance the dimensions can be changed to suit conditions.

Cow Horns Effectively Used in Library Table and Chair

A NOVEL use for cow horns has been discovered by an ingenious craftsman. He has found a means to use them for making furniture.

The illustration shows that the result is not only practical, but presents a unique and decidedly ornamental library table and chair. The horns proved adaptable as well as very substantial. They are tastefully mounted with copper, and in the table form the entire upright construction, the quartersawed oak boards having no other support. In the chair the same general plan is followed, the horns being used as the support, and riveted together at the top to form a comfortable and well shaped back. The lines of both table and chair very closely resemble the design followed in Oriental furniture. Both pieces are rigid, and have been tested to stand a heavy strain. They form a pleasing addition to any library or den, their novelty attracting attention.—L. N. JOHNSON.

A very effective use of cows' horns in the construction of a library rocking chair and table

Open Canoe Cruising

III.—The construction of the lee boards, their location for handling the canoe under sail. Stowing outfit, making a landing and the canoe as a fishing craft

By E. T. Keyser

IN order to sail to windward, lee boards will be needed. Square up two pieces of ¾-in. mahogany, oak or cherry, each 30 in. long by 12 in. wide. On the lower left edge, make a mark 1½ in. from the lower left corner. Lay a line from this point to the lower right corner and saw along this line. With a marking gage, run a line 3¾ in. distant from the right edge at the top. On the right edge,

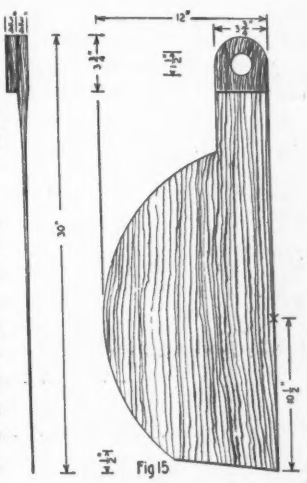
The lee boards as they are fitted to the canoe gunwales for sailing to the windward

mark a point 10½ in. from lower right corner and, with this point as a center, describe an arc with a 12-in. radius from the bottom of board to the line which runs parallel with right edge. Cut out this arc with a compass saw and rip along the parallel line from the top of the board to the arc.

From the waste, cut out two pieces each 3¾ in. square and screw them to the head of the lee boards as indicated in the cross section view. Through center of this square, bore a hole 1½ in. diameter through both lee board and reinforcement and round off the tops of lee boards as shown in Fig. 15. Work down the front edge of the lee board as shown in the cross section; apply a couple of coats of linseed oil with a soft cloth, allowing the oil to soak well into wood between coats, and finish with three coats of varnish well rubbed down between each coat. The lee boards are fastened, one to each end of a 1½-in. axle, by means of sash pins for which holes are bored through both tops of lee boards and axle and are held to the canoe by two straps passing around the ends of the axle and thwart, as shown in illustration. A brass tube long enough to reach from gunwale to gunwale and encasing the axle would allow the lee boards to lower and rise more freely, with tighter buckling of the straps.

A halliard, leading from one of the sash pins to a small cleat fastened to the inwale, on being pulled in will lower the boards for going to the windward while their buoyancy will cause them to rise when the halliard is cast off from the cleat. Pulling out the sash pins allows the removal of boards from the axle and the whole outfit stows compactly when the canoe is under paddle.

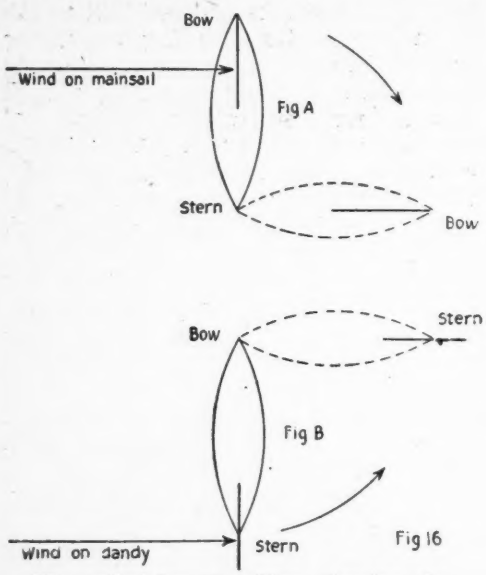
The proper location of the lee boards, the position in which they allow the canoe to do the best windward work, is best found by experiment. Should the best location lie between the thwarts, a pair of large brass screw-eyes may be set into inwale to take the holding straps.



Details of a lee board for use in canoe cruising

The principles of sailing a double rig canoe may be easily understood by studying Fig. 16. In *A* is shown the tendency of the wind pressure on the mainsail to make the canoe pivot on her stern and throw her bow away from the wind, increasing the tendency to capsize. In *B* is shown how the pressure of the wind on the dandy tends to cause the canoe to pivot on her bow and

face the wind, reducing the wind pressure. The mainsail may be regarded as the driving sail and the dandy as the means by which one may round up into the wind and spill the pressure which may threaten to overturn the canoe. This is accomplished by letting out on the main sheet and letting the dandy act as the after



The principles of sailing, showing the tendency of the wind on the mainsail

portion of a weather vane, whenever the wind becomes too strong. A canoe rigged as in the previous article will always tend to point up into the wind and spill the pressure, and can only be kept from luffing by means of the steering paddle which is carried over the same side of the canoe as that over which the main boom is swung at the time.

To hoist sail, trim in dandy sheet so that the boom is amidship, push away from the beach or float. Hoist the dandy and when the canoe has swung around with its head to the wind—and not before this—hoist the mainsail, letting the main sheet be free. Then let out the dandy sheet, pull in the main sheet until the canoe has headway and, when you have gathered steerage way, enough speed to allow of steering, point the canoe on your course. Never lower the dandy first. Always head up into the wind, lower the mainsail and then the dandy.

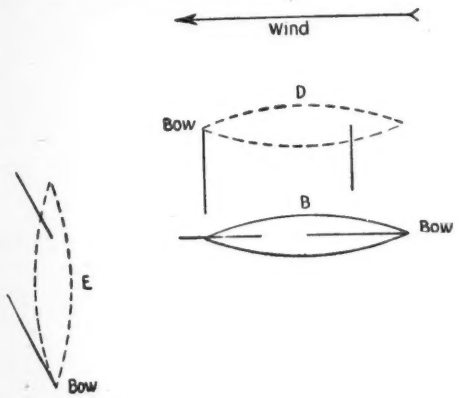
When going about, coming back over the same course that you have sailed, turn the bow of the canoe against and not with the wind. The correct method of doing this is shown in Fig. 17. The arrow shows the direction of the wind. The canoe with a beam wind, is shown at *A* and when the canoe is headed into wind, as at *B*, the wind is spilled from sails and booms amidship, and *C* shows the canoe with the booms on the opposite side and retracing her course. Note that at any time between positions *B* and *C* the canoe may be luffed up into the wind and the pressure spilled.

The improper method is shown at *D* and *E*. At *D* the sails must catch the full force of the wind and the location between *D* and *E*; the booms must go across the canoe with a "flop" which may capsize her. "Gybing" it is called. Furthermore, at no point between *A* and *B* can one ease up by luffing and one must take the full force of the wind without ability to spill any of the pressure. A long narrow and light boat, like an open canoe, has very little momentum when rounding up and some help from the paddle may often be necessary between positions *B* and *C*, but do not be tempted to adopt the other method.

To go about, slacking up on the main sheet and easing up on steering paddle are all that are necessary. When sailing with a beam or a stern breeze allow the lee boards to rise. When tacking, lower them by the halliard. Always have them raised when paddling as they cause considerable drag.

Sailing dead ahead of the wind is the most ticklish part of canoe navigation. The area of the sail that a canoe can carry ahead of the wind is what governs her maximum spread, as the canoeist's weight in this case cannot be opposed to the wind pressure. Also, there is the tendency of the sails to gybe at the slightest shift wind or variation of the canoe's course. This tendency may be recognized from a desire of the main boom to raise or "hike" and should be promptly counteracted by steering a bit away from the side over which the boom is laying. With the wind directly astern and both booms on one side, the dandy will blanket the mainsail to a certain extent and there will be more of a tendency of the canoe to round up. This necessitates carrying more pressure

on the steering paddle which diminishes the headway. It is therefore good seamanship to carry the sails "wing and wing" or with the main boom over one side and the dandy boom over the other. This allows both sails to draw to their full capacity and also reduces the drag from the steering paddle. In event of a tendency to gybe, keep the mainsail full and let the dandy do the gybing as its area is so small that it will not cause



any damage.

Often it will be possible to tack against or take as a beam wind one that is too heavy to run before with the full rig. When it becomes necessary to run before it, round up, lower the mainsail and then scud before it under the dandy alone.

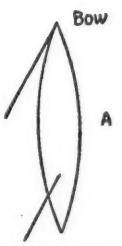


Fig.17

Turning methods in a course

In very heavy weather, the canoe may be turned stern first, the dandy sheet unrove from the deck ring and held in one's hand and the canoe sailed stern foreward under the dandy only. It is well to experiment with the canoe rigged thus, so that you may know just where to place the lee boards so that they will be correctly located for the dandy in this position.

When sailing with a passenger, both of the crew should face forward and the passenger given the management of the lee boards. It is better that the steersman handle the main sheet as he can co-ordinate his actions with paddle and sheet better than two parties could possibly hope to do.

With an outfit aboard, it is best to have considerable weight up forward, if much tacking is to be done, as a canoe somewhat down by the head will make better windward work. The reverse will hold for a long run ahead of the wind in which case it is best to have more weight aft. A passenger, serving as live ballast, can prove quite useful in this respect.

In making a landing at a float or dock, always come up to the landing against the wind or tide, whichever may be the stronger, and when leaving the canoe temporarily tied to a landing, tie her on the side away from which the wind is blowing so that she may ride clear without bumping or scraping. Often, when a light breeze is blowing, the hoisted dandy with boom trimmed amidships will keep the canoe well off the landing against a tide which would tend to run her against the float or dock.

When landing on a beach, except on a falling tide, always pull the canoe well above high water mark, as you may be away from it longer than you had figured upon and a rising or shifting wind might pound her on the sand.

When landing on a rocky shore, unless you can be sure of enough sandy bottom to accommodate the canoe, step overboard and wade ashore before the canoe touches bottom, dragging the canoe until she grounds. Unload her before dragging her up on the beach and load her with only the bow grounded when you embark. Dragging a heavily loaded canoe ashore or down a beach will do her more injury than five seasons' legitimate usage.

One of the chief beauties of a canoe is her adaptability as a fishing craft. With her one may hoist sail, run out to the fishing ground and return under canvas while the other anglers are raising blisters on their hands.

For fishing, it is best to have the canoe anchored by the stern, as then the fisherman will face the direction in which his line is pulled by the tide or his float is blown by the wind. After the mainsail is lowered, the boom may be removed from the mast and the forward end of the sail pushed up under the forward deck

and the after end laid across a thwart out of one's way. The dandy, having a lazy jack, will take care of itself and give no trouble.

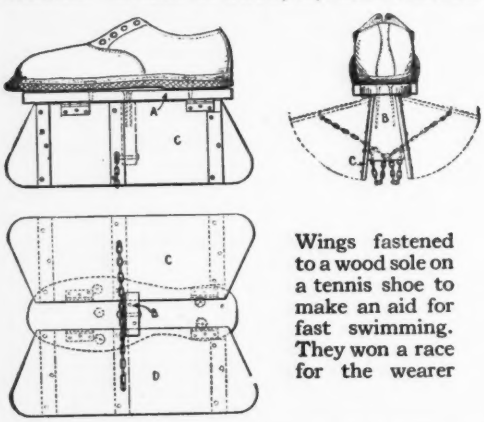
It is well to have a rod long enough to allow the line being passed from side to side of the canoe at will, by passing the rod tip over the main mast head and carrying the line across the bow. This is easily accomplished as the canoe is anchored by the stern. If the fish run to any size, a landing net will prove a great convenience and save many fish.

Fishing in a small river, such as the Delaware, the stern anchor is a necessity as it allows one to drift with the current and drop anchor and raise it without changing the downstream direction of the bow.

(To be concluded)

Wing Attachments on Shoes to Aid the Swimmer

BEING denied the privilege of entering into a swimming contest because he was too young, a boy determined to beat the winner at least and this is the way he did it: To an old pair of tennis shoes he attached the wings as shown in the illustration. A sole of wood, *A*, was attached

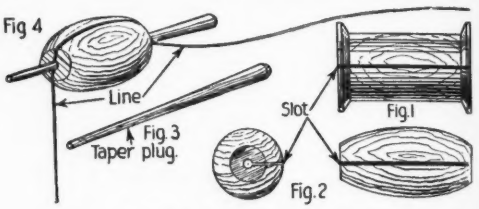


Wings fastened to a wood sole on a tennis shoe to make an aid for fast swimming. They won a race for the wearer

to each shoe and in its center a vertical piece, *B*, was securely fastened. These pieces were cut slightly tapering toward the top. Wings *C* were attached to the wood soles with hinges so that they would lay against the vertical pieces. A chain was attached to the lower end of the vertical piece and to the wings so that they would come to a stop at almost full spread. It is obvious how these wings worked as the swimmer made his strokes. On the day of the race the boy hid the prepared shoes in some long grass near the shore and when the contestants started he quickly undressed, slipped on the shoes and easily beat the winner over the course.—WM. R. HUNN.

A Fishline Float Made of an Ordinary Thread Spool

WITH a float of this type I find the operation of taking on and off a line, as well as of setting for depth, is



A thread spool shaped and fitted with a tapering pin to make a fishline float

accomplished much more quickly than with other floats I have used. A small or large spool, Fig. 1, is trimmed out as shown by the dotted lines, into the shape of Fig. 2. A fine saw cut is made until it connects with the hole in the spool. Through this cut the line is inserted and fastened with a taper hardwood plug. The float can be painted or not, but both float and plug must be given a coat of hot paraffin inside and out.

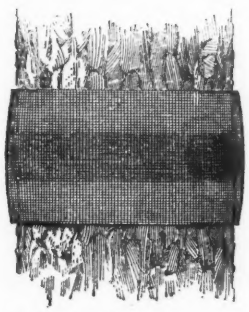
Convenient Material for a Bait-Catching Net

THE fisherman who angles only occasionally usually neglects to supply himself with a bait catching net, and so at the last minute has to seize on the nearest fabric that will not hold water.

If, however, he visits the nearest produce market or grocery store and for a few cents buys one of the ventilated sacks in which onions are shipped, he will have material for either a bait catching net or landing net. These bags are strongly woven in ⅛ in. mesh and will furnish a square of material about 3½ ft. by 3½ ft., which can be conveniently attached to any net frame. Evidently any material strong enough to hold onions will prevent a fish from breaking it.—JAMES M. KANE.

Banding a Tree Trunk to Catch and Destroy Moths

WHEN the codling moth larva has done its best to destroy the appearance of the ripest and rosiest fruits it can find, it seeks a place to spin a cocoon, and for this purpose it generally crawls up or down a tree trunk. Hence the usual method of trapping the moth is to wrap a band of burlap around the tree trunk. An improvement on this method, devised by E. H. Sigler, of the United States Bureau of Entomology, employs a wire screen over the burlap band to form a trap into which the larva enters and spins its cocoon, but from which it cannot escape as a moth.



A burlap band covered with a wire screen

To make the trap, strips of burlap six inches wide are folded into three thicknesses. The loose bark from the lower branches and trunk of the tree is removed. A strip of this burlap is folded once around the trunk and held in place by large tacks, driven in such a way that the edge projects about one-fourth of an inch beyond the burlap. Black-painted wire screening with twelve meshes to the inch is then cut into strips six inches wide, and the edge of each strip is folded twice, allowing one-fourth of an inch to each fold.

The strip of screening should be long enough to allow for an overlap of three to four inches when placed around the tree over the burlap. It is tacked to the tree so that both the upper and lower edges fit snugly against the bark. The projecting tacks used to fasten the burlap prevent the wire from pressing against the cloth. To make sure that no moths can escape through the openings along the edges of the trap or along the flap, a thin coating of pitch tar may be used.

The traps may be placed on the tree during the winter or in the spring, not later than one month after the petals have dropped.

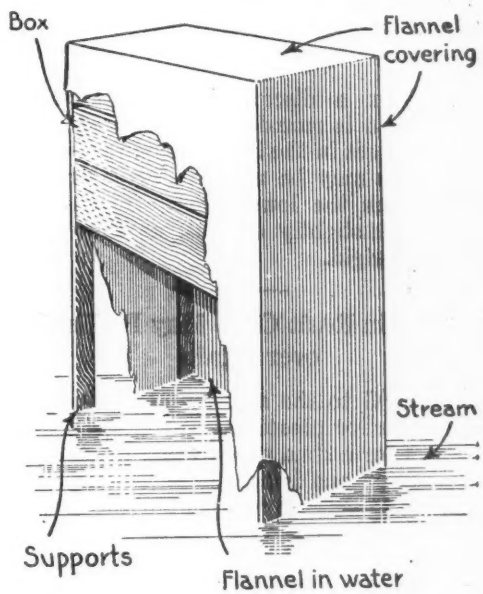
Cleaning the Gilded Portion on Picture Frames

GILT picture frames and chandeliers will, in the course of time, get dirty and turn black. Procure a box of wall paper cleaner and rub some of it over the gilt frame or chandelier. This removes the grease and dirt. Next boil some onions in water so as to get a strong solution. Dip a soft cloth in it and wipe over the frame, polishing with a dry cloth.

Cooling Camp Food by the Evaporation Method

AWAY from an ice supply it is often difficult to keep the food in good condition when no spring is near. However, a very efficient refrigerator that will go a long way in keeping the camp food fresh can be made from a small wood box mounted on stilts as shown in the illustration. Shelves and a door are put in to hold the various dishes.

The whole is then covered with flannel which reaches down into the water below.

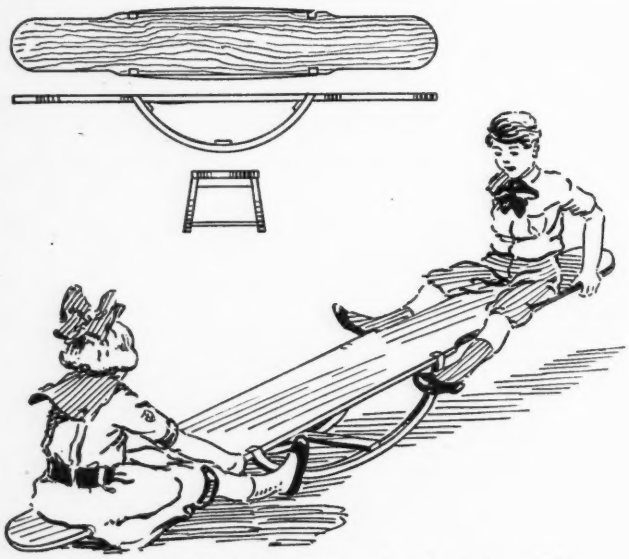


Wood box cloth covered and mounted on stilts in a brook to keep food by evaporation

The evaporation from the cloth will cool the contents of the box in a very efficient manner. Such a device also keeps the food away from the crawling things that infect the woods.—THOS. W. BENSON.

A Rocking Board See-Saw for Children's Playground

THIS excellent piece of furniture for the playground or porch may be easily made of a board and segments of rims from a discarded carriage wheel. The board is rounded as shown and the segments set in the board edge. Supporting strips may be used under the board and across the lower part. These segments are slightly set out, as shown, to make it rigid.



A board with attached segments of a wheel rim making a see-saw rocking board for the children's playground

Old Tin Fruit Cans May Be Used over Again

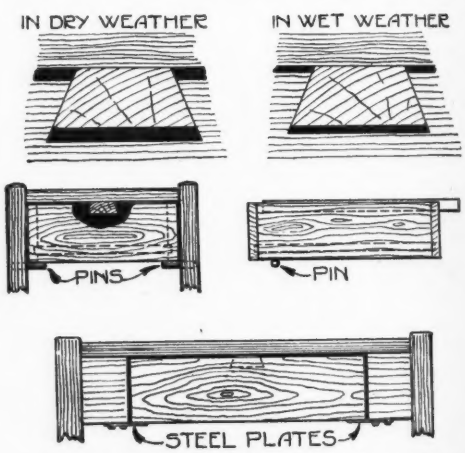
OWING to the scarcity of tin, patent cans for preserving fruit will be expensive for a time at least and difficult to obtain. If one is careful in opening the cans of fruit and vegetables purchased from the grocery store the cans can be used in the following manner: Thoroughly clean and dry the cans as soon as contents are removed and store them away in a dry place to keep them from rusting. When ready to use them again fill the cans to within ¼ in. of the top and then pour melted paraffin in to fill them. Tie covers on of waxed paper and the contents will be preserved as well as in the patent can or glass jar.—L. GERMAINE.

An Overhead Dove-Tail Suspension for Table Drawers

THE method of hanging a drawer here illustrated will be found a simple and satisfactory way out of a difficulty which is often encountered.

This way is practical anywhere where a light drawer, such as is used in library tables, sewing cabinets, and the like, is to be placed in a limited space and a bottom slide and rail are either not possible or undesirable.

The construction simply consists of a dove-tail tongue engaging in a correspondingly shaped notch in the upper edge of the rear end of the drawer, the tongue being fastened either direct to the table-top or to blocks, if the drawer does not come right under the table-top. In front it runs on two pins driven into the table-legs and set back about 1 in. to be out of sight, or, if the drawer does not occupy the entire space between the legs, on a couple of small steel plates screwed to the edge of the side-ends and protruding about ½ in.



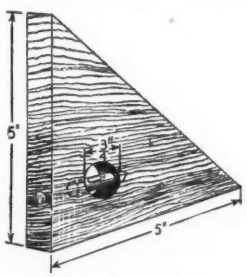
A dove tail table hanger for a drawer to eliminate the sticking drawer slides

This way of suspending a drawer has many advantages. It is extremely simple

and requires very little work, and it gives the greatest possible amount of usable space. If properly put in, it will never bind because the points of contact are small and any swelling or shrinking of the working parts are automatically compensated. Therefore, an extremely close fit can be made without any fear of trouble later. This method is far superior to the usual way of hanging such drawers by grooves in the sides which engage tongues, and where any slight warping or swelling of either side or tongue immediately produces binding, unless a very loose fit has been made. It makes for good appearance, too, there being no unsightly grooves to show in the sides when the drawer is pulled out.—HENRY SIMON.

How to Make a Pocket Plumb and Level in a Block

THE only materials necessary to make this most serviceable little tool are a plain level glass and a small hardwood block. The block should be from ½ to ⅝ in. thick and triangular in shape, the angle of one corner being a right angle and the sides equal. Draw the hypothenuse and on it mark the center of the sight-hole. Through this, and parallel with one side, draw a line and square it across one edge. Mark the center and bore a hole just large enough to admit the level glass, keeping the bit straight by sighting along the pencil line. The bore should go just deep enough so that the center of the level glass will coincide with the center of the sight-hole.



A level glass set in a triangular wood piece

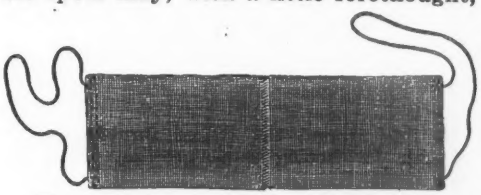
Now bore the sight-hole with a ¾-in. bit. Put a few drops of glue into the end of the bore for the glass, slip the glass into place, drop a little glue on its end, and seal the hole with a dowel.

The level should now be left untouched until the glue is set, and then the edges trued up with a block-plane, care being taken to true up the long edge also.

This level is very light and fits the pocket. It accomplishes with one level-glass what it ordinarily takes two to do and not only that, but it permits truing-up work inclined at an angle of 45 deg. to the horizontal, which is at times extremely useful. It has another advantage, too—it can be used to lay out miters when no other tool happens to be at hand. —HENRY SIMON.

Making Camp Hammocks from Gunny Sacks

PERSONS contemplating camp life during vacation in almost inaccessible spots may, with a little forethought, provide themselves with some of the luxuries of the home. For instance, the hammock, which is difficult to carry, can be made from large bran or peanut sacks in which the outfit may be packed for transports. At the camp cut round sticks as long as the sack are wide, attaching a strong cord for a hanger at either end and drop one into the bottom of each sack, passing the cords out between the meshes at the corners. Sew the tops of the sacks together with strong twine or string and the result will be a hammock that, when suspended between two trees, is a near approach to a spring bed. The sacks may be used for the duffle on the return trip—GALE PINCHNEY.

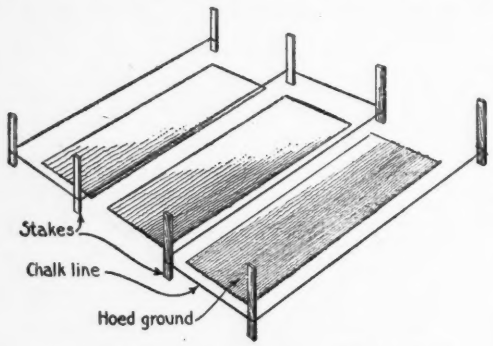

Two bran or peanut sacks sewed together with a hanger at each end for a hammock

A Cement for Mending Valuable China Dishes

VALUABLE china may be mended with the following mixture, and when dry it will resist hot water and ordinary usage. Mix a teaspoonful of alum and a tablespoonful of water. Place in a hot oven until it is quite transparent. Wash the broken pieces in hot water, dry and put them into the oven until they are warm; and while still warm coat the broken edges with the mixture thinly and quickly as it sticks instantly.

Stakes with Guide Lines for Hoeing Garden Beds

FREQUENTLY the gardening enthusiast plants the seeds and then forgets all about them. When next he views the patch he is unable to tell the weeds from



A line around the stakes furnishes a guide for hoeing small growing plants

plants. Here is a sure plan that will enable him to hoe out all the weeds possible without cutting the little plants. Always mark out the ends of each row with proper stakes, marking the stakes with indelible pencil with the name of the plant in the row. When hoeing or weeding time comes, run a chalk line along the rows from stake to stake as shown in the sketch. This will give a guide line alongside of which one can hoe as close as he desires. The remaining weeds, being mixed with the plants will, of course, have to be weeded out by hand to prevent their injury.—JAMES M. KANE.

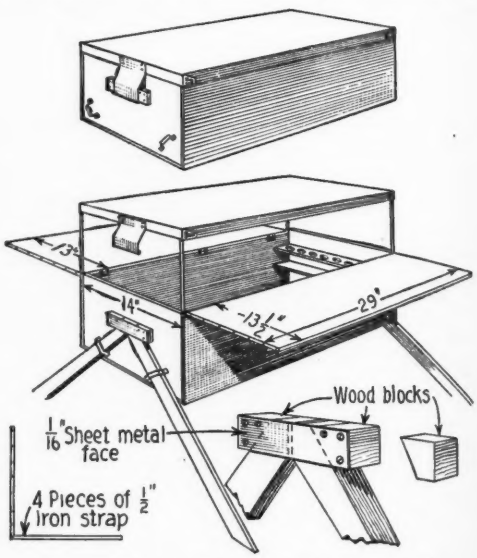
A Combination Camp Kitchen Cabinet and Table

THE combination cabinet and table illustrated was the result of the refusal of my family to take a long outing unless they could carry some conveniences with them. "Roughing it" did not appeal to them. The table will accommodate four persons comfortably and extra compartments may be added as required.

The box is made of ½-in. material 30 in. long, 14 in. wide and 12 in. deep at the sides, and 12½ in. deep at the ends. There are two hinged wings, each 28½ in. long, one 13 in. wide and the other 13½ in. wide. These are hinged to the upper edges of the side boards. On each end of each wing is an L-shaped piece of metal ½ in. wide and ¼ in. thick. These are fastened with screws, making the wings 29 in. long over all. These iron pieces are put on so that the end not fastened to the wing will stand in a vertical position as the wing hangs out from the box.

The cover is made of sheet metal with the edges turned down and the corners riveted. The inside measurements are such that when it is slipped over the top of the box it will fit snugly. The upper ends of the vertical pieces of metal fit into the corners of the metal cover when the wings are extended and will prevent them from dropping farther than a horizontal plane.

The inside of the box may be arranged to suit the individual builder. On the ends of the box are fastened blocks of wood cut as shown. A metal strip is fastened across their faces to form a pocket for the upper ends of the legs. Two saddle strips are also fastened to the ends to slip the legs through as shown. The metal cover has two clips fastened to



A camp kitchen table and cabinet for making almost every convenience of the home

the ends. These clips project and form a hook to catch under the blocks for the upper ends of the legs, and hold it in place when folded for shipment.

When opened up as illustrated it provides a raised table top and two wings. This leaves the contents of the box accessible while at lunch.—J. D. BOYLAN.

Simple Designs for Sheet Metal Working

XIII.—Other interesting problems developed by means of radial lines

By Arthur F. Payne
Director of Vocational Education, Johnstown, Pa.

THOSE of you who have worked out the radial line problems as demonstrated in the last two issues will have acquired an understanding of the fundamental principles of the methods of pattern development by means of radial lines, that will make these more complex problems easy to understand and develop.

The new points introduced in these problems are the use of old principles in new ways, and the use of short cuts. If any difficulties are experienced in working these problems it will be of advantage to review the problems of the last two issues.

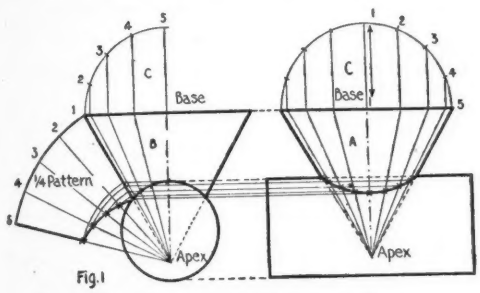


Fig. 1

One method of developing a pattern to make a hopper for entering a round pipe

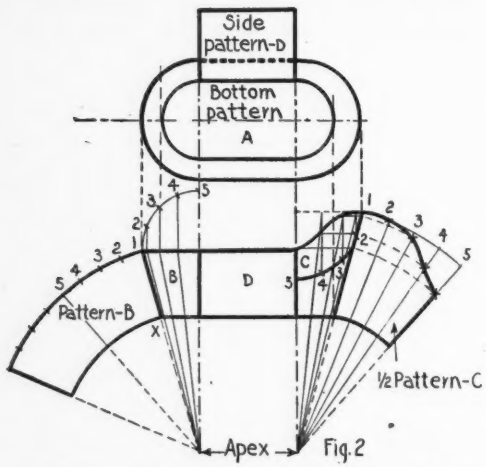
The illustration (Fig. 1) shows the method of developing the pattern for a hopper entering a round pipe. A more technical statement of the problem would be "the development of a cone intersecting a cylinder;" sometimes these technical statements are confusing if the terms used are not understood. In the previous problems, the base of the cone has always been placed at the bottom; in this one the base is at the top and the apex at the bottom; this makes it appear different, but the method of developing this problem is exactly the same. Another new point is that to save time and labor we have developed only one quarter of the pattern, using only one-quarter of the bottom view. The steps taken for the development of the pattern are as follows:

First, draw the front view, *A*, the exact size wanted. Before we have gone very far we shall find that we cannot complete the front view without the aid of the end view, *B*. The joint line of the cone and cylinder is not absolutely necessary to develop the pattern, and the method of finding the joint line has been explained earlier in the series, but as this problem offers a splendid chance to review, it is deemed advisable to take advantage of the opportunity. Second, to complete the front view by drawing the joint line, we must draw the end view, *B*. Third, draw the top view, *C*, of the base of the cone on both front and end view, divide these half circles as usual and project the points to the base lines and then to the apex. Fourth, be very careful about numbering these points as a mistake will cause a lot of trouble. In the front view point number 1 is in the center of the base line and at the top of the half circle as indicated by the arrow line, but on the end view the same point number 1 is on the left hand side because we are looking at the problem from a different view point. Fifth, to get the joint line on the front view, *A*, project lines across from end view, *B*, where the radial lines from the base to the apex cross the joint line between cone and cylinder. On the front view, *A*, where these projected lines cross the same numbered lines going from the base to the apex, place a cross, then connect these crosses with a freehand curve and the front view will be complete.

To develop the pattern will be easy enough for the students of this series who have completed the preceding problems. Briefly the steps are: First, draw the pattern arc, 1-5, getting correct length by stepping off the spaces from the top view, *C*. Second, project the radial lines from the point of intersection with the joint line to the line apex-1, to get the true lengths as was done in all the preceding problems. Third, swing these lines over to the pattern until they cross

the same numbered lines, then make a cross, connect these crosses with a freehand curve and the one-quarter pattern is complete.

The illustration (Fig. 2) shows the method of developing the pattern for a bath



A pattern for a bathtub is developed in a similar manner to a hopper and pipe

tub. Notice that the tub is made up of five parts, bottom, two ends and two sides. The pattern for the bottom needs no development as the top view, *A*, gives us a true pattern. The patterns for both ends and one side must be developed in exactly the same manner as that described for Fig. 1, and will not be repeated here. Notice that it is one-half of a cone and developed in the same manner as for the hopper and pipe.

The pattern for the end, *C*, is developed in the same manner, except that the base circle has been drawn downwards instead of upwards as was done on end view *B*. This method is often used and was introduced here so that the students of this series might become familiar with it. The base circle is divided and the points projected to the base line, then to the apex in the usual manner. The points where the radial lines from base to apex cross the curved line of the tub are projected over to line apex-1 and then swing across the pattern until they cross the same numbered lines in exactly the same manner as described for previous problems.

The pattern for the side, *D*, is easily drawn. The correct width is obtained from *D* front view. The height is not correct on the front view because the top edge is leaning towards us. The correct height is obtained from the line, 1-X. It is the same height as the side, *D*, and has the same angle of inclination or slant, therefore, the line, 1-X, is the true height of the side, *D*. Set off the width from *D* and the height, 1-X, and the pattern for all parts is complete. Allowance must be made on these patterns for seams, and wiring as shown in previous issues.

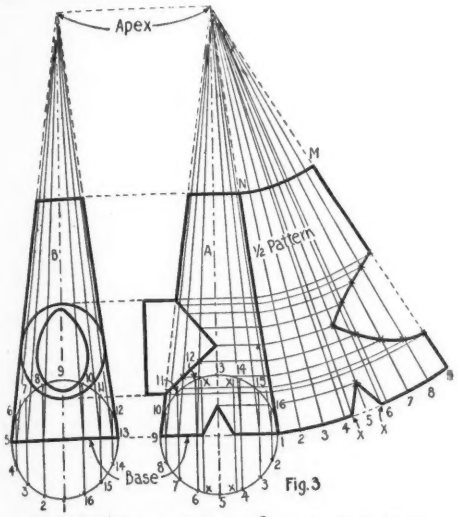
The illustration (Fig. 3) shows the development of patterns for an "egg tester." A lighted candle is placed inside and the eggs are held against the egg-shaped hole. This must be done in a dark room. If the egg is clear and transparent it is fresh; if cloudy it is old. If it shows a dark spot, the process of incubation has started. The V-shaped hole at the bottom is to admit air so that the candle will burn brightly.

The technical description of the problem would be "development of pattern for a cylinder intersecting a truncated cone." As stated before, these terms are often confusing to the non-technical reader, but advanatge should be taken of every opportunity to become familiar with them.

The development of the pattern for the round pipe (cylinder) has been described so many times in various ways in this series that no further description is deemed necessary, neither is it shown in the drawing. The best explanation will be found in the December, 1917, issue, "Development of Pattern for Tee Joints." The egg-shaped hole is drawn freehand.

The development of the pattern for the cone gives us an opportunity to review the use of auxiliary points and to make use of a still different method of drawing the bottom view and base line circle. The steps taken are as follows: First, draw front view *A* and side view *B*. Second, complete the cone by continuing the side lines until they meet at the "apex." Third, draw the bottom view, that is the circle on the base line. Notice that this is the first time that we have drawn the full circle on the base line. In previous issues it has been dropped down some distance from the front view to avoid confusion, but it is now time that we become acquainted with these different

methods. Fourth, divide the circle into sixteen equal parts. Project lines from these points direct to the base line, then direct to the apex; these are the radial lines. Fifth, from where these radial lines cross the joint line of the cone and cylinder, project lines straight across to

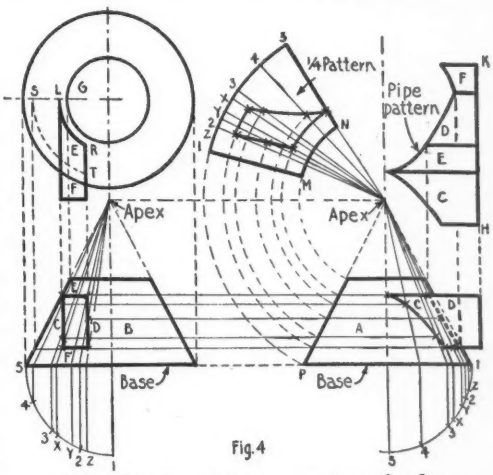


Developing a pattern for an egg tester which is a truncated cone and round pipe

the line apex-1 to get the true lengths. Do the same with the V-shaped opening at the bottom. Sixth, draw the top and bottom pattern arcs, *N-M* and 1-9, getting the correct length by transferring the spaces from the bottom view circle. Seventh, from the numbered spaces on the pattern arc, draw lines to the apex. Eighth, take the true length points on line apex-1 and swing them over the pattern until they cross the same numbered line coming up from the pattern arc, making crosses. Connect these crosses with a free-hand curve. Ninth, to get the pattern for the V-shaped opening, get the true height by projecting straight across to the line apex-1, then swing the line over to radial pattern line, 5. To get the true width we must make use of "auxiliary points," as we have done once or twice before. On the front view project lines straight to the bottom view circle (points marked X). With your dividers take the distance on the circle from point 4-X and lay off on the pattern arc as shown in the drawing. Do the same for the other distance, 6-X, connect the three points and the one-half pattern will be complete.

The illustration (Fig. 4) shows the development of patterns for a "Dust collector Intake." The technical description of this problem is "Rectangular four-sided Prism Intersecting a Truncated Cone off Center."

The steps in the development of the pattern are as follows: First, draw front view, *A*; the joint line cannot be drawn until the points are projected across from the side view, *B*. In this problem the joint line is absolutely necessary and is obtained by drawing the bottom circle on both front *A* and side *B* views (as only one-quarter pattern is needed, only one-quarter circle is drawn). Second, space and number each bottom view quarter circle as in the preceding problems. Be very careful to number these correctly. Notice that 1 is at the right on front view *A*, but in the side view *B* it is in the exact center. Third, from these numbered points draw lines straight up to the base line, then straight to the apex. Fourth, on side view *B* where the lines to the apex cross the end view of the rectangular pipe make marks as in the drawing and draw lines across to the front view, *A*. Where they intersect the same numbered lines coming up from the bottom make a cross. It will be noticed that if we use only the regular numbered lines coming up from the bot-



A dust intake collector or rectangular four-sided prism intersecting a truncated cone

tom view quarter circle we shall not have enough points to definitely locate the joint line on front view *A*, so we must again make use of the "auxiliary lines."

On the side view *B* draw a line from the apex through the lower left-hand corner of the rectangular pipe until it strikes the base line, then drop it straight down to the bottom view quarter circle, mark *X*. Do the same with the upper right-hand corner and the lower right-hand corner, marking them respectively *Y* and *Z*. Now transfer with the dividers from the side view *B* bottom quarter circle to the front view *A* quarter circle the points *X*, *Y*, *Z*, getting the correct distance from points 2 and 3. From *X*, *Y*, and *Z* on the front view *A* draw lines straight up to the base line, then to the apex. Now draw the lines over from the side view to the front and make crosses just as you did with the regular numbered lines. Connect the crosses and you will have the complete joint line. The dotted part of the joint line is drawn dotted because it is invisible, as it is back of the pipe.

Now that we have the joint line we can proceed with the development of the cone pattern. It is only necessary to develop one-quarter because the important part is the hole and by marking off the pattern four times we can get the full pattern. This also saves metal and bulkiness of patterns.

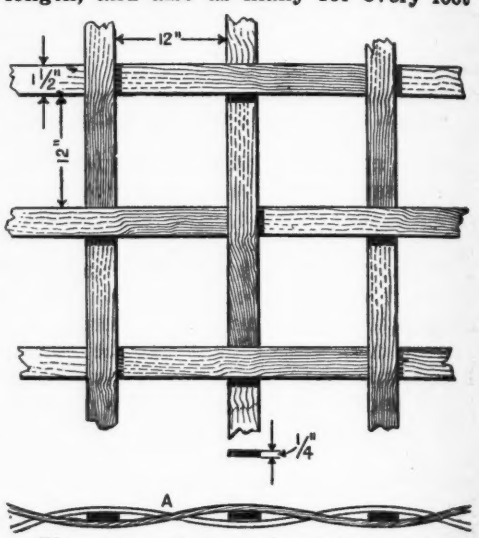
In the usual manner draw the top and bottom pattern arcs 1-5 and *M-N*, getting the correct length as usual by getting the spaces from the numbered points on the bottom view circle. Be sure and include the "auxiliary points." Then from the points where the lines we used to get the joint line cross the line apex-*P*, draw circles around to the pattern until they cross the same numbered or lettered lines. Where they intersect make crosses, then connect these with curves and the one-quarter pattern will be complete.

Now we have to get the pattern for the rectangular pipe. Notice that we already have the correct pattern for the two long sides of the pipe on the front view *A*. The front side is marked *C* and the back is marked *D*. Transfer the size and shape of *C* to the pattern, using the line *H-K* as a base line, getting the correct lengths from the end view of the pipe on view *B*. We must next get the pattern for the top of the pipe. This is done by the use of the top view *G*. Project two lines upwards from the rectangular pipe to points *L* and *R* on the top view, then draw the arc *L-R*. From the front view *A* get the correct length of the pipe and set it off on the top view *G*. This will give us the pattern for the top of the pipe *E*. Place this with *C* on the pipe pattern, next transfer the side *D* from the front view. To get the pattern *F* for the bottom of the rectangular pipe: On the side view *B* draw a line from the *F* to the line apex-5. Then up to point *S* on the top view. Then draw the circle *S-T* as indicated and you will have the pattern for the bottom *F*. Place this next to *D* and the pipe pattern is complete.

(To be continued)

Making a Lattice Trellis for Roses and Vines

A GOOD trellis for roses and vines may be made as follows: Procure as many 1½-in. by ¼-in. strips of wood as there are feet to the width and of the right length, and also as many for every foot



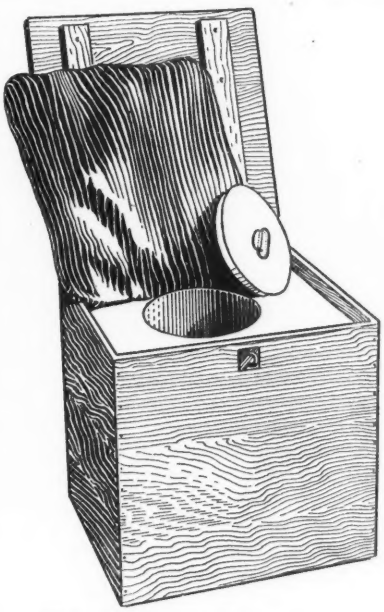
The strips of wood are interlaced in the construction of this trellis for roses

in length and proceed as follows. First lay out marks 12 in. apart on the strip to be used as a base, then tack the pieces that are to be used upright to these, each alternating piece on the other side from that nailed last, then interlace the cross pieces in these lengths as in weaving. The trellis will then have the appearance as shown at *A*. This lacing of the strips makes the trellis quite substantial.—LOUIS M. WAHRER.

How to Make an Efficient and Inexpensive Fireless Cooker

THE materials needed are a box, or some other outside container, some good insulating material, *B*, a kettle for holding the food, a container for the lining of the nest in which the kettle is to be placed, and a cushion or pad of insulating material for the cover on top of the kettle, and a cover, *G*.

For the outside container a tightly built wooden box as illustrated is the most satisfactory. The box should have a hinged cover, and at the front a hook and staple to hold the cover down. A window fastener answers the purpose well. The size of the box should be large enough to allow for about 4 in. of packing material all around the nest in which the kettle is set.

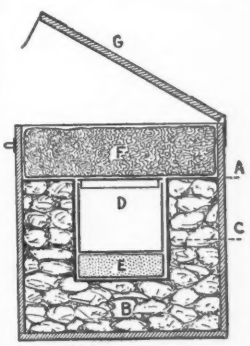


The outside container may be any box of a convenient size

The kettles used for cooking should be durable and free from seams or crevices, which are hard to clean. They should have vertical sides and the covers should be as flat as possible and provided with a deep rim fitting well down into the kettle to retain the steam. The size of the kettle should be determined by the quantity of food to be cooked. Small amounts of food cannot be cooked satisfactorily in large kettles, and it is therefore an advantage to have a cooker with compartments of two or more different sizes. Kettles holding about 6 quarts are of convenient size for general use. Tinned iron kettles should not be used in a fireless cooker, for, although cheap, they are apt to rust from the confined moisture. Enameled kettles are satisfactory, especially if the covers are of the same material. Aluminum vessels may be purchased in shapes which make them especially well adapted for use in fireless cookers and, like enameled ware, they do not rust.

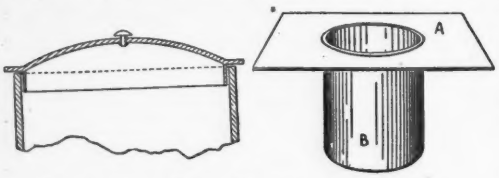
The container for the cooking vessel, or the lining for the nest in which it is to be put, should be cylindrical in shape and deep enough to hold the cooking kettle. It should fit as snugly as possible to the cooking vessel, but at the same time should allow the latter to be slipped in and out freely. If the cylinder is too large the air space between it and the kettle will tend to cool the food. For making this container a galvanized iron or other metal bucket, *B*, may be used or, better still, a tinsmith can make a lining of galvanized iron or zinc which can be provided with a rim, *A*, shown on following page, to cover the packing material.

For the packing and insulating material a variety of substances may be used. Asbestos and mineral wool are doubtless the best, and have the additional advantage that they do not burn. Ground cork or the packing from Malaga grapes, hay, excelsior, Spanish moss, wool, and crumpled paper may also be used satisfactorily. Of the inexpensive materials that can be obtained easily, crumpled paper is probably the most satisfactory, since it is clean and odorless, and, if properly packed, will hold the heat better than many of the others. To pack the container with paper, crush single sheets of newspaper in the hands and pack a layer at least 4 in. deep over the bottom of the outside of the container, tamping it in or pounding it with a heavy club. Stand the container for the cooking vessel, or the lining for the nest, in the center of this layer and pack in



Section through cooker showing insulation

more papers about it as solidly as possible. Whatever packing material is used, it should come to the top of the container for the kettle, and the box should lack about 4 in. of being full. A cushion or pad must be provided to fit completely the space be-



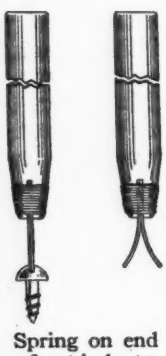
The cover with a deep rim and the container for the cooking vessel within the box

tween the top of the packing and the cover of the box after the kettles are put in place. This should be made of heavy goods, such as denim and stuffed with cotton, crumpled paper or excelsior. Hay may be used, but it is somewhat odorous.

The classes of food best adapted to the cooker are cereals, soups, meats, vegetables, dried fruits, steamed breads and puddings. When different foods are cooked together in the fireless cooker they must be such as to require the same amount of cooking, since the cooker cannot be opened to take the food out without allowing a large amount of heat to escape, It would not do to put foods which need about 1½ hours to cook in a cooker with, say, a piece of meat that requires several hours' cooking.

A Driver for Holding a Screw While Turning It

TAKE a round piece of wood, something like a lead pencil, of the required length, run a fine saw lengthwise through the end of it; then take a discarded clock spring, cut two pieces of equal lengths and insert them in the saw with the curves out. Wind it securely, pinch the ends together, insert them in the slot of a screw and you can hold it at any angle. If a watch spring is used and the ends made keen enough the device can be used to drive very small screws.—E. L. GRIFFITH.

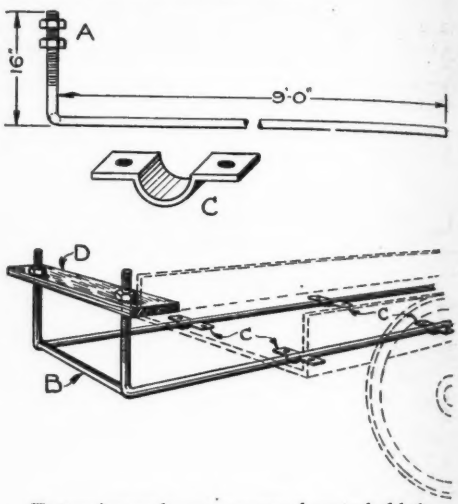


Spring on end of stick to start screws

Extension Holder for Hauling Long Stock on Express Wagon

THE holder is made of two bars, each 9 ft. long and ¾ in. in diameter. They are bent at right angles on one end to make an upright 16 in. high. These pieces are joined together with another piece of the same stock welded in as at *B*. The length of this piece will be regulated by the width of the express wagon box on the inside.

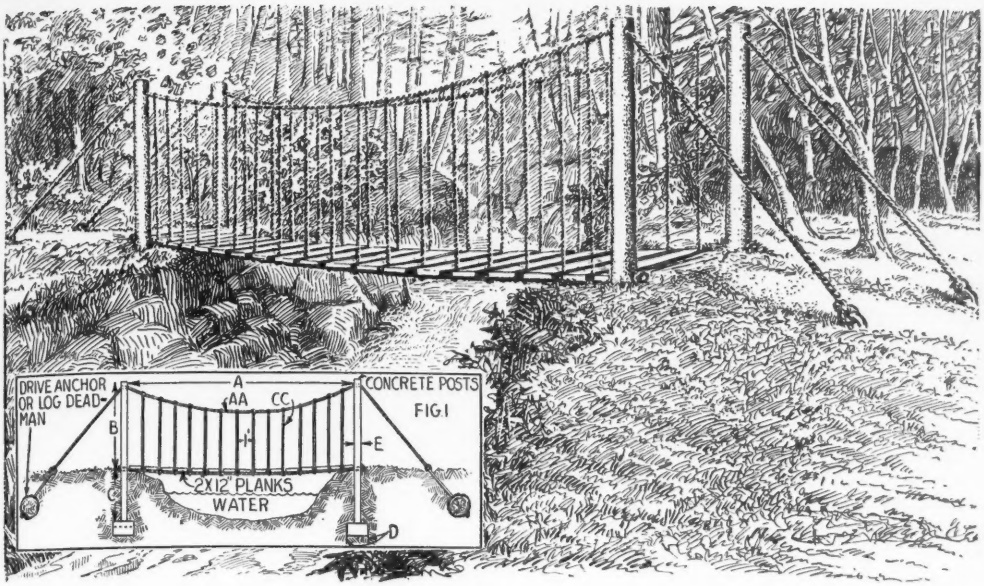
The bars are held in place inside of the wagon box with four pieces of metal shaped as shown at *C* and made from stock 1 in. wide and ¼ in. thick. These are bolted to the upper surface of the bottom of the wagon box.



Extension rods on a wagon box to hold the pipe ends and keep them from lashing about

The upper ends of these rods are threaded for almost their entire length and fitted loosely with two nuts. A crossbar, *D*, made of stock 2 in. wide and ¼ in. thick is drilled to fit on the rod ends between the nuts, *A*.

In hauling long rods, pipe or lumber the holder is slipped in place in the clips, *C*, and the material loaded on it. The crossbar, *D*, is then put on and the nuts adjusted to hold the load. This prevents the long ends of the material extending from the rear of the box from lashing about and makes it possible for the load to be placed against the front end of the wagon box, where it will not extend over and strike the horse. This device is very serviceable.—JAMES E. NOBLE.

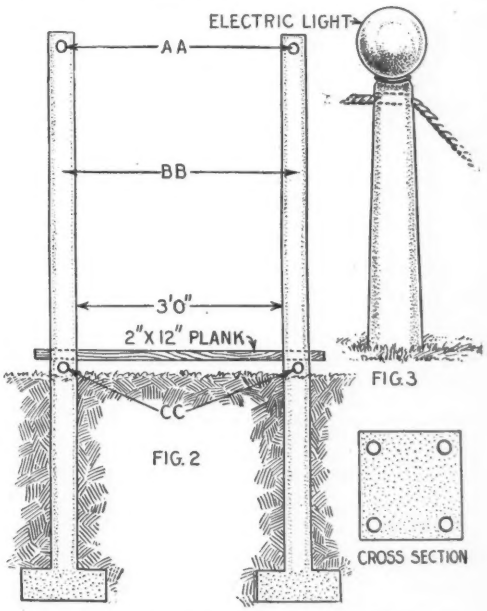


A Rope Suspension Bridge for a Garden

SUSPENSION bridges present a very artistic structure for spanning small streams or a brook on the grounds or in a park. The illustration gives the details of such a bridge and tables of proportions for construction of the different lengths.

The concrete posts which hold the upper cord of the bridge are built and reinforced as shown in Fig. 1. The suspension cable is secured to a drive anchor, expanding anchor or dead man and then run across the ravine and secured on the opposite side in the same manner. Both suspension cables should be the same length and have the same amount of slack or sag. The lower cord is drawn as taut as possible and then hung perfectly level by the supporting vertical cables, which should be spaced about 1 ft. apart. When all vertical cables are secured to both the upper and lower cords the latter is drawn up again and secured at each end.

Planks are laid across the lower cord and held in place by driving large staples over the rope and into the bottom of the plank. The tables should be studied closely. Table 2 gives the size of the post, length above and below ground and size of spread footing, while Table 3 gives the size of the ropes to use for the various lengths of the span. In the last column of this table is given the size of the bottom cord of round iron bar, which is used in place of manila rope, and in Table 4 is given the number and size of the bars necessary to reinforce the columns shown or mentioned in Table 2.



A cross section of the completed bridge and the detail of the anchor post and its base

The illustration, Fig. 2, gives a cross-section of the completed bridge, while Fig. 3 shows a little more detail of the

anchor post. Of course the builder can exercise his own ingenuity in designing the posts and in the method of connecting the upper and lower cords, but two half-hitches of the vertical cables around both the upper and lower cords will answer the purpose. Care must be taken to see that

A	B	C	D	E
6 ft.	5 ft.	4 ft.	14 in.	7 by 7 in.
8 "	6 "	4½ "	14 "	8 " 8 "
10 "	7 "	4½ "	18 "	8 " 8 "
15 "	8 "	5 "	20 "	10 " 10 "
20 "	10 "	6 "	24 "	12 " 12 "

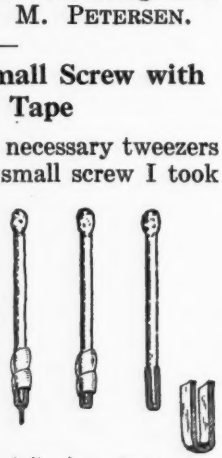
A	AA	BB	CC Hemp	CC Iron
6 ft.	⅝ in. dia.	⅝ in. dia.	⅝ in. dia.	½ in. dia.
8 "	¾ " "	⅝ " "	⅝ " "	½ " "
10 "	1 " "	⅝ " "	¾ " "	⅝ " "
15 "	1¼ " "	¾ " "	1 " "	¾ " "
20 "	1¼ " "	¾ " "	1 " "	¾ " "

Size of Post	Size of Rods	Number of Rods
7 by 7 in. by 9 ft.	⅜ in. dia.	4
8 " 8 " " 10½ "	⅜ " "	4
8 " 8 " " 11½ "	½ " "	6
10 " 10 " " 14 "	½ " "	8
12 " 12 " " 16 "	⅝ " "	8

the cables are kept free from chafing and all ropes and cables should be well soaked in good hot pitch before the work is finished or decay will ruin the bridge in a short time.—George M. Petersen.

Starting a Very Small Screw with Adhesive Tape

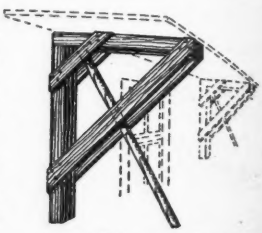
BEING without the necessary tweezers to handle a very small screw I took a match-stick and put a piece of adhesive tape on it as shown, then wrapped it with another piece to hold it to the stick. The screw-head adhered to the tape well enough to permit its being placed in position and given a couple of turns before it was necessary to use a screwdriver.—James M Kane.



Adhesive tape on match to start screws

A Scaffold for Holding in Place with a Pole

THIS device I saw in use by some country plasterers who were re-plastering the very high end of a farm house. Each one was made of two pieces of 3 by 4-in. stock, about 3 ft. long for the upper part, and 4 ft. for the other side of the angle. To make it, nail the two pieces together to form an angle. Then prepare two pieces of 1-in. white pine board, and nail one end to the outer end of the horizontal arm, and the other end to the bottom of the vertical part. Also fasten the two pieces at the top of the angle, as shown in the illustration. The long pole is used to push the bracket up against the side of the house into position, at any desired height, and according to the length of the pole. The double braces keep the scaffold from turning side-ways on the pole when placed on the side of the house.



Portable scaffold brackets for work on house exteriors

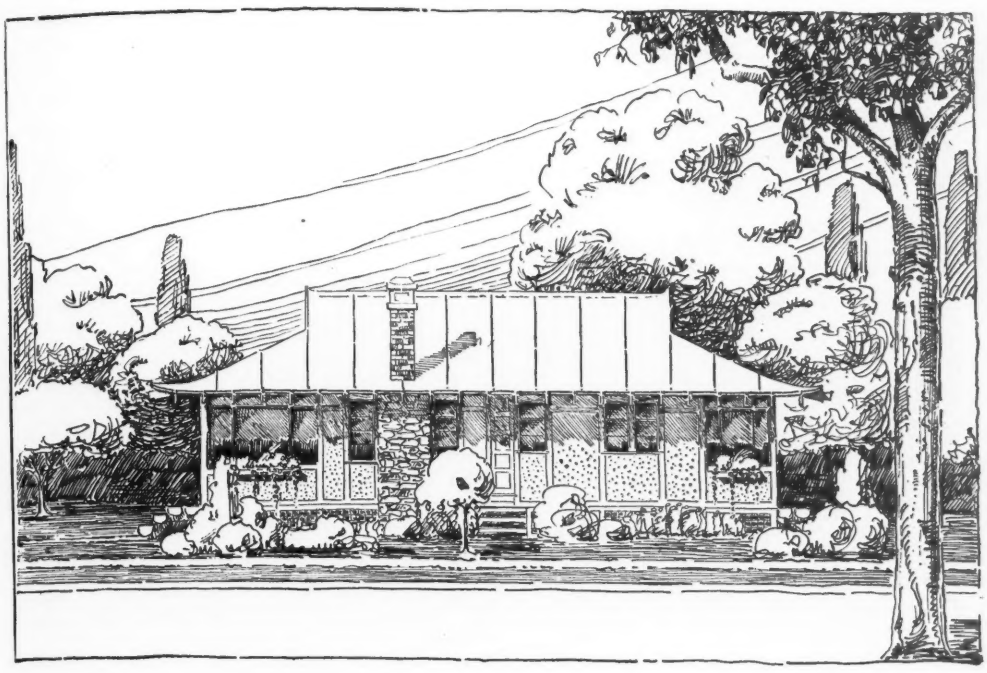
Such a scaffold will hold almost any weight, for the more the weight the tighter it will hold, though the pole should have firm footing, not too soft, but not hard enough to cause slipping. Two of the brackets will do ordinary jobs, but as many brackets may be used as may be necessary, of course. This scaffolding has many features to commend it to workmen.—A. A. Kelly.

Holding Photographic Plates from Tray Bottom

THE developing of plates in a flat tray in a darkroom is often a very bothersome task, because the plates stick to the bottom of the tray when one wishes to remove them for examination and at the end of the development period. An excellent plan to avoid this trouble is to stretch a rubber band loosely over and round each end of the tray through the developer and then lay the plates on the sagging rubber bands, which will prevent the plates from sticking and improve the general results.

A Convenient Summer Cottage

By C. M. Tomlinson



THE cottage proper is 18 by 24 ft.; an 8 ft. screened-in porch at each end makes the total length 40 ft. The low cost is made possible by choosing the dimensions so that stock sizes and lengths of lumber, doors, sashes, etc., may be used. With a little care in buying there is little waste, and in many cases no cutting is required.

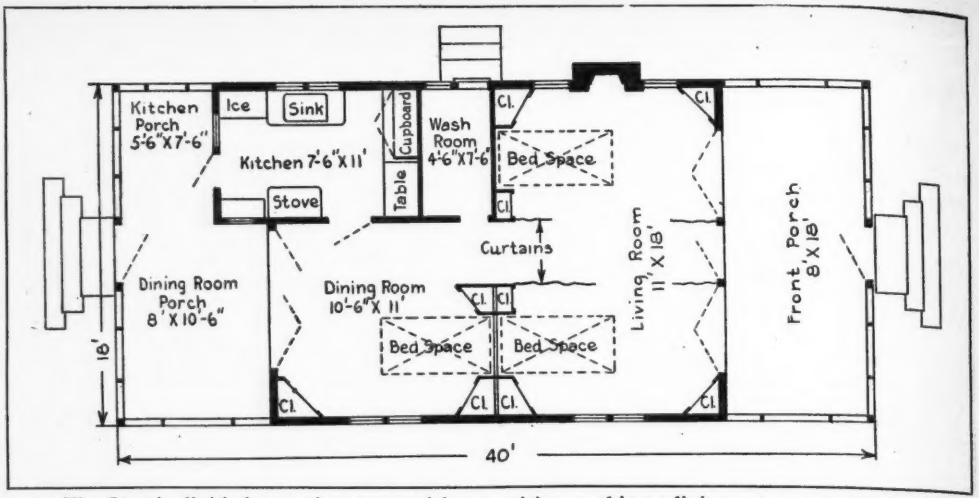
To secure the maximum of accommodations, every device known to the modern builder is used. The floor is divided near the middle by a partition, making a living room at one end and a dining-room and wash room at the other. A fireplace on one side of the living room assures comfort on cold mornings, chilly days, and during the cool weather of late fall or early spring. Recesses 12 in. deep in the partition provide space for three swinging beds which are screened off by partitions during the day. Occupants of each of the beds in the living room secure privacy by dropping curtains from the ceiling; a passage way through the center of the room is left at all times, and one-half of the living room may be occupied by those sitting up late when the other half is used as a bedroom. The spaces in the partition not required for the beds are utilized for closets.

The doors of the porches fold back so that by opening them wide the area of the living room and dining-room are really made to include the additional space. The wash and dressing room has an entrance from the outside so that bathers need not track through the rest of the building to reach it.

Bookcases are built into the walls between windows, and the walls of the wash room and kitchen likewise utilized for the appropriate built-in furnishings. Trunks may be placed in the corners behind the doors and screened off.

The cottage is so planned that it may be built in sections, the structure making a harmonious whole at each stage. If desired the wash and dressing room may be made a little larger and used for a maid's or chauffeur's room. A second story may be added for about $200.

By making the greatest possible use of the cottage, the following accommoda-



The floor is divided near the center with a partition, making a living room at one end and a dining-room and wash room at the other and a fireplace in one side of the living room

tions are provided by the ingenious arrangement:

By day: Living room 11 by 18 ft., with fireplace, or with front doors open to include porch, 18 by 19 ft. Dining-room 10 by 11 ft., or with doors open to include porch, 10 by 19 ft. Kitchen 7 by 11 ft., with kitchen porch 6 by 7 ft. Wash and dressing room 4 by 7 ft. Front porch 8 by 18 ft. Rear porch 8 by 10 ft.

By night: A front porch 8 by 18 ft., which by the use of screens may be turned into a sleeping porch. Rear porch almost as large capable of same use. Two front bedrooms each 7 by 11 ft. One rear bedroom 10 by 11 ft. If the sleeping porches are utilized and a cot placed in each bedroom, sleeping accommodations for a dozen people may be provided.

How to Make an Automobile Spring Leaf-Separator

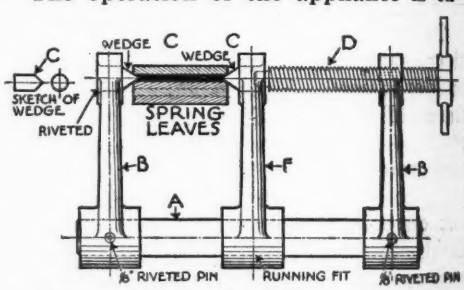
THE body springs of an automobile should be periodically lubricated. This will result in greater comfort to the occupants as well as in quieter riding.

A common practice on the part of the average driver is to separate the leaves of the springs with the aid of a hammer and chisel or a screw-driver. Procedure such as this, however, is extremely detrimental to the well-being of the springs, the constant hammering causing unnecessary strain on the leaves.

The accompanying sketches illustrate the construction of a simple appliance which was built from discarded automobile parts such as may be found in the junk pile of any average garage repair shop. It consists essentially of a rod, *A*, to both ends of which are riveted levers, *B*, (discarded brake levers). The pointed plugs, *C*, are riveted into the upper end of one lever, while screw *D* passes through the upper end of the other lever.

A third lever, *F*, placed between the levers, *B*, is bored out at its hub to permit its sliding smoothly over the shaft, *A*. In addition its upper end is provided with a plug, *C*, similar to that placed in the other lever. The plug in the lever, *F*, however, is bored out at one end to receive the pressure from the screw, *D*.

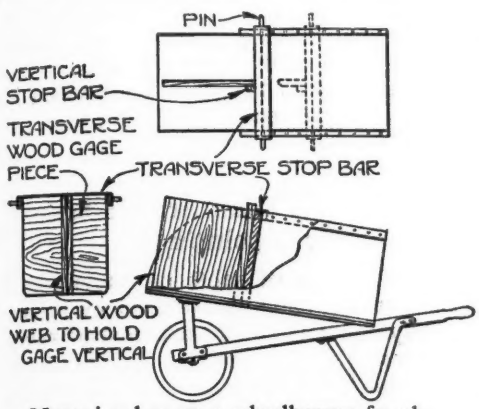
The operation of the appliance is extremely simple. Turning the screw, *D*, forces the plugs, *C*, towards one another; consequently when they are placed between two leaves of the spring, a few turns of the screw will readily separate them.—ADOLPH KLEIN.



Levers mounted on a bar carrying cone points for separating the leaves of a spring

Self-Measuring Wheelbarrow for Concrete Aggregates

A SELF-MEASURING wheelbarrow designed to promote convenience, rapidity and accuracy in handling concrete aggregate, is shown in the accompanying sketch. It consists of an ordinary



Measuring box on a wheelbarrow for obtaining the proper amounts of concrete

steel body wheelbarrow pan with a transverse wood gage of the same shape as the inside of the pan. This gage is moved up and down in the pan, according to the amount of concrete to be carried, the latter being measured between the gage-board and the rear end of the pan. The gage-board may be set at any desired position by means of a transverse bar across the top of the pan. The bar is held in place by two pins inserted through any one of a series of small holes along the sides of the pan at the top. The gage-board is held against the transverse bar by a vertical wooden piece nailed to a web fitted to the gage-board at right angles to it at the open end. When the concrete is to be dumped, the gage-board is removed.

Applying Grease to Working Gloves to Make Them Wear

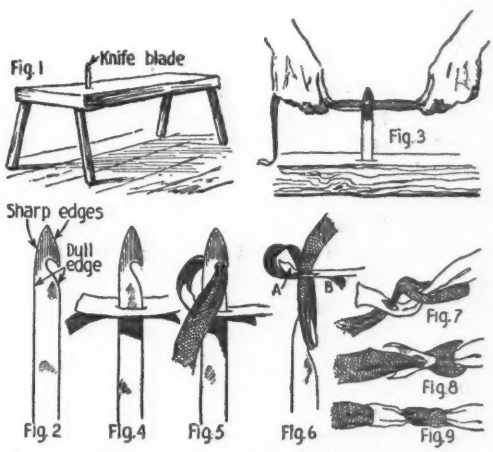
A FRIEND of 'mine who does heavy work of various kinds which requires gloves, and heavy leather gloves at that, advises me that gloves can be made to wear almost like iron by applying axle grease sparingly and being very careful not to get it on the cloth stitching, as the axle grease may disintegrate it somewhat.

Making a Photographic Timer out of an Ordinary Watch

A SIMPLE adaptation of an ordinary watch to use as a timer of value in long photographic exposures by photo-engravers and printers, or for use in timing action of developer, can be made by painting a narrow line on the under side of the edge of the watch crystal. Then, by revolving the crystal till the mark coincides with the minute hand, it is easy to register the exact time that exposure began.—GEORGE PARKE.

Joining the Ends of Carpet Rags Without Sewing

AN old backwoodsman used this method of joining carpet rags end to end, without sewing the strips together. He mounted a strong knife blade, previously shaped like a crochet needle, as shown in Fig. 1, on the bench he used for a seat. The point and upper edges of the knife were sharpened as shown in Fig. 2. Taking the ends of two strips, he pressed them down over the blade, Fig. 3, until they were as shown in Fig. 4. One end was looped under the eye of the needle, Fig. 5, and while holding the ends *A* and

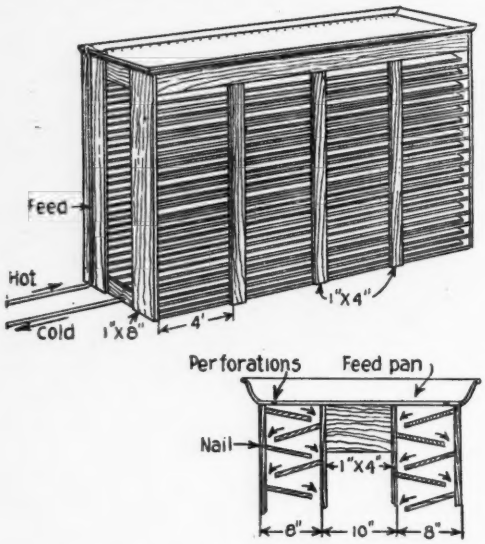


Knife blade arrangement for fastening the ends of carpet rags without stitching

B, Fig. 6, they were drawn upward. The resultant knot, Fig. 7, can be shaped as in Fig. 8 and drawn tightly as in Fig. 9. Other pieces are attached in the same manner to make a continuous line for the weaving.—JAMES M. KANE.

An Inexpensive and Effective Water Cooler

IN the usual gas-engine installation the water is circulated through a large tank where it is cooled by radiation. Ordinarily this process answers every purpose,



Numerous boards arranged in a rack to spread the water for cooling it in the air

but in the case of small ice plants, now becoming rather common, a much greater cooling effect is desired. The accompanying illustration shows a simple and yet very effective cooler in which the cooling principle utilized is that of evaporation. The apparatus is easy to construct and the cost is low, as it is made almost entirely of wood.

Briefly stated, the method consists in emptying the heated water into a long, narrow galvanized-iron pan, perforated along each side with a series of small holes. The water drips in fine streams through these and falls on a board inclined toward one side, which becomes thoroughly and uniformly wet on its upper side. The water then trickles off the lower edge onto a similar board inclined in the opposite direction. The wetting action is here repeated and the water falls onto a third board, and so on for twenty or thirty drops, according to the cooling capacity desired. It is finally caught by another galvanized iron pan at the bottom, from which it is pumped for use again.

Aside from its cheapness and ease of construction, the wood has a distinct advantage over metal in that the water spreads out in a uniform layer, whereas on metal the tendency of the water is to trickle down in small irregular streams.

The cross-sectional diagram clearly shows the relation of the sloping boards and the two pans, while an idea of the general appearance will be gained from the perspective view. When used on the shady side of a building, in a region where the humidity is low, the evaporation is rapid and the cooling effect really remarkable.—JOHN D. ADAMS.

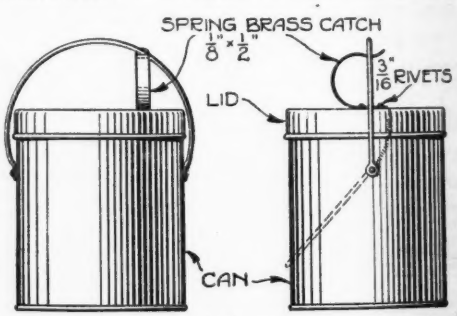
Renewing a Worn Artist's Brush by Repointing It

THE points of sable or camel's-hair brushes such as are used by artists rapidly wear away, thus rendering them practically worthless.

An apparently worthless brush may be restored by dipping the bristles in glue, pointing it as well as possible at the time. When thoroughly hardened the brush is repointed on a sharpening stone the same as if it were a steel point. It can be done even more rapidly by holding against a slowly revolving emery wheel. The glue is then dissolved by immersing in hot water.—L. B. ROBBINS.

A Spring Lock for the Cover of a Garbage Can

THIS lock is for attaching to an ordinary garbage can, built like a pail having a bail. The spring catch, as illustrated, is riveted to the can cover,



Spring catch on a garbage can cover to hold it in place with bail in upright position

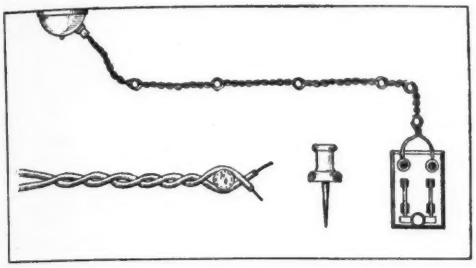
the upper part snapping under the bail when it is in an upright position for carrying.—P. P. AVERY.

The Amateur Electrician

And Wireless Operator

A Cleat for Holding Temporary Electric Wires

THE accompany illustration shows a simple means for holding temporary wiring in place. The cleat is nothing more than the handy little glass push pin that can be purchased at any stationery store. It is very easy to attach, does not mar the surface of the wall and, being glass, is of course an insulator. The pin is first forced into the wall and then the double conductor cord is slipped over the head.—EDWARD R. CULLEN.



Glass push pins used as temporary cleats for electric light and telephone wires

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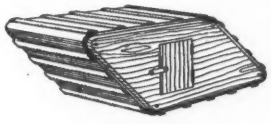
An Electrically Driven Toy Tank That Goes "over the Top"

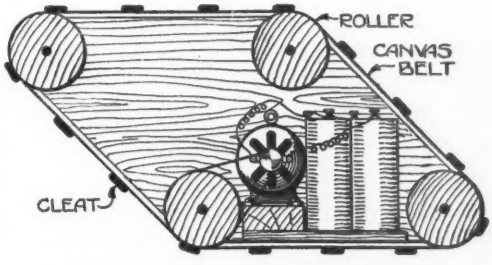
THIS caterpillar tank will crawl along the ground, go "over the top" of miniature trenches, plunge through wire entanglements, and push aside or climb anything that is in its path. It is a small model of the latest machines that the British Army has been using so successfully.

Two side pieces cut from ¼-in. pine wood in the shape of a diamond 12 in. long, constitute the frame. At each corner of the frame a roller is placed. These should be 6 in. long and 2 in. in diameter. A small nail driven through the frame corner and into the center of the end of the roller makes a shaft that is good enough for the purpose.

Now for the construction of the interior. Between the bottom edge of the frame-pieces a shelf should be nailed and upon this fastened the batteries and an electric motor, which will furnish the power. These should be secured with screws so that in case the tank tips over they will not be jarred out of place. Belt the pulley of the motor to the nearest roller and wire the batteries to the motor.

Over the four rollers a canvas or leather belt is laced snugly. To keep from slipping this belt should have several narrow wood cleats nailed upon it. A small door in the frame makes a convenient place to get to the motor in order to turn on the power, etc. It is evident that when the current turns the motor that the rollers will revolve, and, as the belt grips the ground securely because of the cleats it





A toy tank made of wood and inclosing a motor and batteries for the power plant

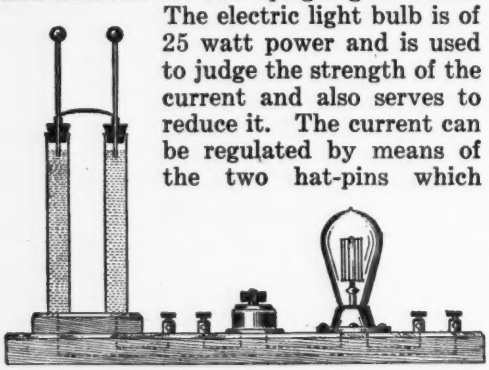
carries, the caterpillar tank will crawl slowly along. The motor is of the small, toy size; from 4 to 6 in. high being plenty powerful enough.—F. E. BRIMMER.

Durable Terminals for Electrical Conductor Cords

THE terminals of flexible conductor cords often become frayed with use, a condition which results in poor connections and short circuits. A good terminal is made as follows: Peel back the insulation on the cord until a clean surface is obtained; then cut it off squarely and bend the end into a symmetrical loop. Dip the loop first into soldering flux and then into molten solder, holding it until the solder "takes." This forms a solid terminal which can be screwed down tight without injury and will prove satisfactory.—THOS. A. REYNOLDS.

Shocking Device That Works on the Commercial Current

AN electrical shocking device which gives an even, soothing effect to the nerves is preferable to those which produce slow, intermittent discharges. An apparatus for producing the soothing current is quite easily made. The source of current is an 110 volt A.C. which is reduced by resistance. The main source of resistance is the weak solution of salt and water in the two upright glass tubes. The electric light bulb is of 25 watt power and is used to judge the strength of the current and also serves to reduce it. The current can be regulated by means of the two hat-pins which



Resistance in two tubes to reduce alternating current for a shocking machine

project through the stoppers of the tubes. One set of binding posts is for the main circuit, the other is used for the transmission of the current into the body. A set of handles made from the carbons of old dry cells are used for hand-grips.

To regulate the shocker, see that the switch, shown in the center of the illustration, is turned off. Then short-circuit the hand-grips and turn on the switch Push down the hat-pins in the tubes until the wires in the bulb are reddened. Note the amount of water that is between the connection points of each tube. Add the two amounts and increase the distance between them about 8 in. A very low current should be flowing through the apparatus and it is now quite safe to grip the handles. The current can now be varied to suit.—JOHN C. JACK.

Locating and Repairing Short-Circuited Armature Coils

TO locate a short-circuited armature coil, pass a current from a battery of dry cells, or a storage battery, through the armature, using the brushes of the machine for terminals. Using a low-reading voltmeter, touch its lead wires to one pair after another of the adjacent commutator segments. A zero deflection of the voltmeter needle indicates a short-circuited armature coil.

It will be seen, at periodic intervals in passing around the commutator, that the meter deflection reverses, and that just preceding this transition point the value is less than normal deflection. This merely indicates the passage from one pole to another on the winding. Thus, for instance, on a four-pole armature, there will occur four such reversals. Switching of the voltmeter leads will cause the meter to register in the right direction.

If a "short" is found, clean out the spaces between commutator segments, to be sure that no mental dust is responsible for the trouble. If this trial fails, carefully lift out the coil connected to the bars to which the short-circuit was traced, and repair any insulation breaks.

If a winding is broken, the break may be located by connecting a battery through an ammeter to two metal strips, held apart by a piece of wood, at such a distance that they will touch adjacent bars on the commutator. Holding this device against the commutator surfaces turn the armature slowly by hand. A reduced or zero deflection of the meter indicates a broken or open-circuited winding. The only thing to do in this case, is to lift out the damaged coil, solder the ends together, re-insulate the break, and place the wire back in its proper slots on the armature.—PETER J. M. CLUTE.

Electrical Devices and How They Work

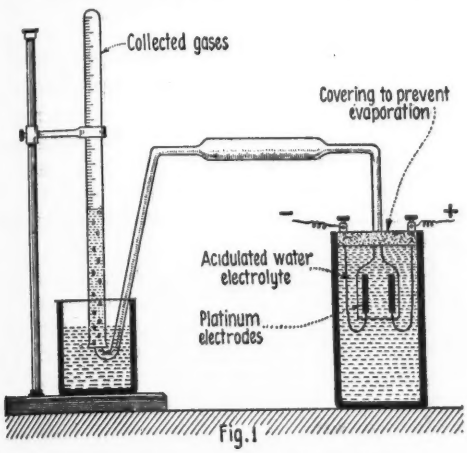
VI.—Electrical metering instruments

By Peter J. M. Clute, B. E.

ELECTRICITY is manifested to us only through certain effects which it produces. These effects may be mostly classified under chemical, thermal, magnetic, and static effects.

Chemical effect is manifested by the decomposition of a solution when a current of electricity passes through it.

Thermal effect is produced by the passage of an electric current through a conductor of appreciable resistance.



A gas voltameter consisting of two platinum electrodes immersed in acidulated water

Magnetic effect results from an electric current in a conductor when brought into a magnetic field, the field being produced by a magnetic or other electric currents.

Static effect is the attraction or repulsion existing between highly electrified bodies.

These effects all occur in perfect accordance with definitely fixed natural laws, and as a consequence they have been utilized in the design of various instruments for the measurement of electrical qualities.

Electrolytic meters, depending on the chemical effect of the electric current, do not indicate directly in amperes the current flowing, but are used to determine the quantity of current which passes in a definite period of time. Thus, they should be termed coulomb, or ampere-hour, meters. In Fig. 1 is shown the gas voltameter or electrolytic meter. The gas voltameter consists of two platinum electrodes immersed in acidulated water, so arranged that all the evolved gas would be collected in a graduated cylinder. It can thus be demonstrated that the amount of gas is entirely independent of any consideration by the quantity of current flowing. By using solutions of different metals for electrolyte, it can be shown that the weight of metal deposited on the positive electrode is always proportional to the amount of current in the circuit.

The commercial electrolytic instrument depends on the principle that current passing through a volume of water decomposes it into its constituent gases, hydrogen and oxygen. This decomposition is directly in proportion to the current passing, one ampere-hour decomposing .338 gms. of water. The current flows through a volume of water contained in a properly graduated tube, the change in volume of water in a given time, indicated by the difference in levels, showing the amount of current which has passed.

The commercial use of electrolytic meters is quite limited, and in most cases they have been superseded by direct-reading electro-magnetic type meters.

The thermal effect of electric current is utilized in some instruments to measure the current passing, by means of the expansion of a wire. The heating of a wire is proportional to the square of the current and the resistance of the wire, when a current is passed through it.

Hot-wire instruments are used to measure current or differences in potential by the heating effect of the current. Referring to Fig. 2, a long wire, of high resistance, non-oxidizable metal, has one end fastened to a plate, passes over a pulley and back to the plate. A spring attached to the plate keeps the wire stretched taut. When a current is passed through the wire, it heats and expands,

the increase in length causing the pulley to rotate, carrying the arm with it. This arm movement causes the silk fiber to rotate the shaft, which carries the needle.

Hot-wire meters deflect in the same direction for currents in either direction and are equally accurate on direct and alternating current. They are not affected by stray magnetism and have the advantage that they can be calibrated on direct for use on alternating current. This type of instrument is not generally employed in practical work, but is valuable for measuring currents of high frequency, such as are used in wireless telegraphy.

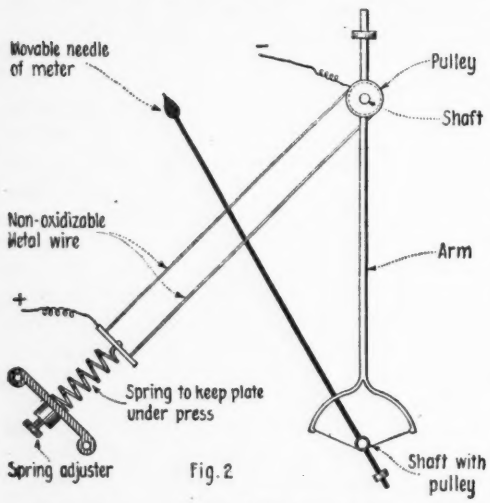


Fig. 2

Hot-wire meters deflect in the same direction for currents in either direction

The simplest form of meter employing the electromagnetic effect is the galvanometer, an instrument for detecting small currents. In Fig. 3 is a so-called tangent galvanometer, the operating principle of which is as follows: If a coil of wire is placed in the plane of the magnetic meridian (*N* and *S* line), and a magnetic needle is suspended at its center, a current passing through the coil will deflect the needle away from the magnetic meridian by an angle whose tangent is proportional to the current strength.

The D'Arsonval galvanometer is a modification of the tangent galvanometer, with reversed positions of moving and fixed elements. In this instrument, there is a small solenoid oscillating under the directive force of a permanent magnet, instead of a suspended magnet moving under the directive force of a coil. Current which is lead to the coil through its suspension causes it to rotate about its axis, with a tendency to place itself at right angles to the lines of force. A pointer may be fastened to the coil to show the deflections, or a mirror may be used, from which a reflected light ray forms the pointer. In most forms of this instrument (see Fig. 4) a soft iron core is supported between the magnet poles from the rear, leaving a space between core and magnet, in which the coil swings. This tends to increase the magnetic field in which the coil rotates, giving a more sensitive deflection.

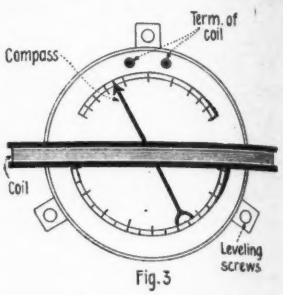


Fig. 3

The simplest form of a tangent galvanometer

Galvanometers are generally used to indicate the presence and direction of electric currents rather than to ascertain their intensity. The D'Arsonval principle, however, can be applied to portable meters for the direct measurement of voltage and amperage. When used to measure potential or E. M. F. they are called voltmeters, and are graduated to read in volts; and when measuring current, they are called ammeters, and read the current in amperes. In Fig. 5 is shown the D'Arsonval principle as applied to instruments of this sort.

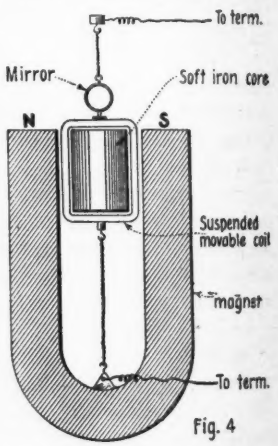


Fig. 4

A soft iron core supported between permanent magnetic poles

In fundamental principles, ammeters and voltmeters are alike, inasmuch as the deflecting torque of the instrument is

proportional to the strength of the magnetic field multiplied by the current flowing in the movable coil. An ammeter, since it measures the current flowing in the conductor, must be placed in series in the circuit and hence its coil should have as low resistance as possible. On the other hand, a voltmeter, inasmuch as it measures the potential difference between two wires, should be placed across these wires, and, therefore, should have a high resistance so as to take but a small current. Since the voltmeter's resistance is fixed, the current through the meter will be proportional to the E.M.F. in volts, so that, like an ammeter, a voltmeter really operates in obedience to current variations.

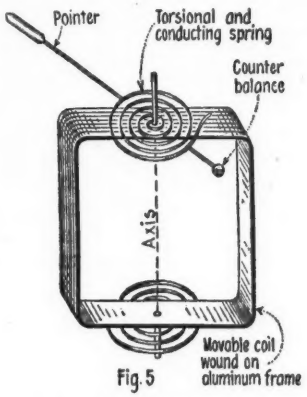


Fig. 5

Movable element in the D'Arsonval type

In the ammeter, the movable coil is composed of a few turns of larger wire than is used in the voltmeter. When designed for small capacity, the total current to be measured may be passed directly through the coil. For heavy currents, in excess of the ampere capacity of the wire or in excess of full-scale meter deflection, a portion of the current is shunted through a low resistance circuit called a shunt, which is paralleled in the circuit of the movable element. Thus, by using a suitable shunt, a current of any magnitude may be measured.

In the voltmeter, the moving element consists of many turns of fine wire in series with which there is a resistance. This resistance is such that, when maximum voltage is applied, the current through the movable coil is limited to the amount necessary to give full scale deflection.

Electrometers are instruments depending upon the mutual attraction between opposite electrostatic charges. If a source of E.M.F. is connected to two metallic plates, they will take charges in proportion to their potential difference, and a certain electrostatic attraction results. If one of the plates is permitted to move, the electrostatic capacity of the system increases, thus increasing the amount of the charges and the force of attraction.

This principle is employed in the construction of electrostatic voltmeters, adapted for the measurement of high voltages. This meter is easily insulated, of simple construction, requires no internal resistance wire, it consumes no current on D.C. and practically none on A.C., its deflections are independent of the frequency, wave form, and stray magnetic fields, and it indicates equally well on direct and alternating current.

The electrostatic voltmeter, shown in Fig. 6, consists primarily of fixed and movable metallic vanes of relatively large surface, generally plane, but sometimes curved. The two terminals are connected, one to the fixed part and the other to the movable part, which has a pointer attached to give the deflections on a graduated scale. The type of electrostatic voltmeter shown is designed for potentials of 1,500 to 10,000 volts.

In addition to the above standard types of electrical meters, there is still quite a number of other instruments designed for special uses. These include:

The frequency meter, or indicator, used to determine the frequency or number of complete cycles per second of an alternating current.

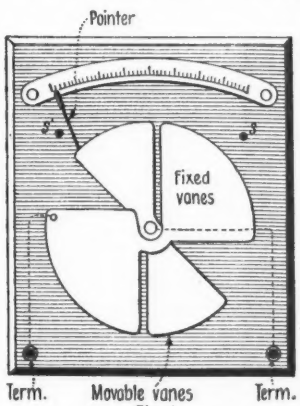


Fig. 6

The voltmeter consists of fixed and movable vanes

The wattmeter used for measuring directly in watts the power expended in a circuit. Wattmeters are of either the indicating or recording type.

Ohmmeters used to give directly the value, in ohms, of a resistance that is being measured.

The dynamometer, a moving coil meter, used for measuring currents,

E.M.F.'s, and power on both D.C. and A.C. circuits.

The permeability bridge, an apparatus designed for the determination of the magnetic densities of iron corresponding to given magnetizing forces.

The hysteresis meter used for measuring the hysteresis in sheet iron and steel.

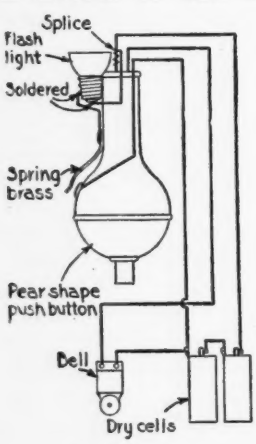
The Wheatstone, or slide-wire, bridge used for the accurate determination of resistance.

The above discussion includes the principal types of meters and instruments used in the testing of electrical apparatus. While there are other meters on the market, it will generally be found that they are simply modifications of one or the other of the above typical meters, or are designed for very special or limited use.

(To be continued)

A Combined Electric Night-Bell and Flash-Light

IN rigging up a bell for an invalid it was decided to add an extra wire and have a flash-light as well as a bell. The bell and light are independent of each other, although one of the bell wires is also used for the light and the same batteries work them both. The drawing shows clearly how to connect the wires.

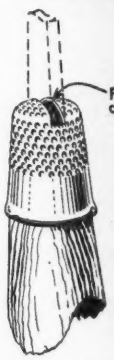


A battery lamp on push button

A pear-shaped push button is used for the bell and connected in the usual way. The flash-light with its reflector is held in place by binding it with adhesive plaster. The switch consists of a piece of spring brass and a round head screw. After all the connections are made, the whole neck of the push button is wound with tape. Pushing the switch lights the light, pushing the button on the end of the push button rings the bell. Two cells of dry battery will be sufficient to work either the light or bell.—ALBERT E. JONES

A Thimble Used as a Ferrule on a Tool Handle

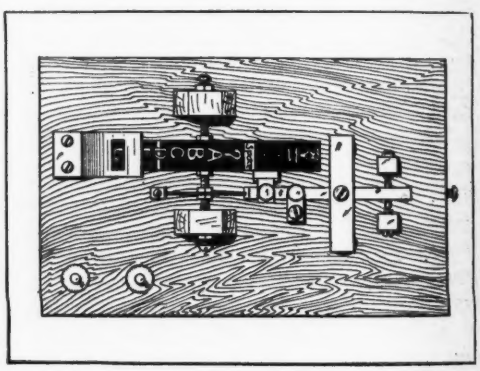
AN old thimble makes an excellent ferrule for a small screwdriver handle or a similar tool. A notch is filed in the thimble end to admit the rectangular shank of the tool like a flat file. Round shanks may be fitted into a drilled hole or the thimble end cut off entirely for tools like an awl or chisel. The small indentations will hold firmly in the wood if the end is fitted snugly; however a prick punch or a small hole with a brad driven in will keep the thimble in place on the handle. The round end of the thimble makes a very neat fitting ferrule that is not obtainable in the ordinary kind.—JAMES M. KANE.



Thimble on wood handle

A Self-Translating Telegraph Line for Amateurs

THOSE electrical experimenters who have possessed a private telegraph line know what fascination there is in communicating with a friend by this means and also know what a wonderful possibility of misunderstanding there is in such a device when the operators have only a speaking acquaintance with the standard telegraph code. There is no doubt that many more amateurs interested in electricity would have such a line

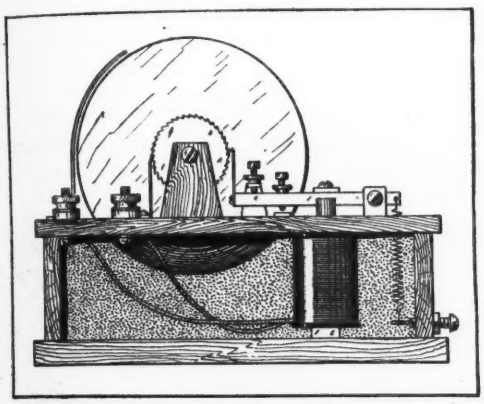


Forty divisions around the face of the wheel for necessary alphabet characters

were it not for the difficulty of learning the code sufficiently to understand what comes over the wire. And it is to make possible a line which sends automatically and automatically translates its signals that the device illustrated herewith was developed.

The principle made use of involves the so-called "step by step" method of producing synchronous motions at separated points and makes use of the ordinary telegraph sounders and keys and the ordinary battery.

Reference to the drawings will show that there is provided a flat wooden wheel having around its periphery forty divisions to correspond to the forty necessary characters of the alphabet including the numerals and the necessary punctuation marks. To the shaft of this wheel is rigidly attached a thin metal rachet wheel,



The wood wheel with a thin ratchet wheel attached to turn it as the sounder works

such as can be purchased at the store of any gear supply dealer, having forty teeth. This shaft is mounted to rotate rather stiffly between bearings formed by screws having holes drilled in the tips, the shaft being pointed at either end to bear in the holes. The bearing screws are mounted in wood pedestals, as suggested by the drawings, and the whole mounted on a suitable base. A telegraph sounder, or any similar arrangement of magnets and lever, is arranged under the wheel and has mounted at the end of the lever a thin piece of spring metal which is bent so as to form a hook to engage with the ratchet. As will readily be seen this arrangement causes the letter wheel to revolve through the space occupied by one letter every time the sounder arm is drawn down. There is also another piece of flat spring metal to prevent the wheel going backwards and also to press on the ratchet continuously so as to prevent it turning too freely and thus getting out of time.

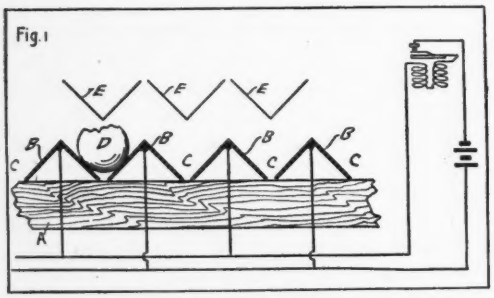
From the above description, the use of the apparatus will be plain. There is provided at each end of the line one of the letter wheel machines, a telegraph key and a battery, all connected in series as in an ordinary telegraph line. When one wishes to transmit he opens his key lever and makes "dots" until the letter he wishes comes to the opening in the shield over the type wheel, then he pauses long enough to let the receiver know that that letter is to be copied, then proceeds to the next letter and so on. The end of a word is signified by a space, and the end of a sentence by a period or question mark. The method is, by its very nature, slow, but is quite accurate, which is more than can be said of the ordinary amateur Morse line. After some practice, fair speed can be obtained though.

Certain refinements naturally suggest themselves to the amateur—such, for instance, as having an extra wire or a duplex circuit to force a strip of paper up against the wheel, which would have rubber type set on it, thus producing a printing telegraph. It is also evident that the line described is a closed circuit line and consequently gravity batteries should be used as the current flows all the time when no message is being sent. This is, of course, the most reliable type of line, but there are many well-known ways of producing an open circuit line on which ordinary dry batteries may be used.

Another method requiring a fair amount of interesting developing work is to use low frequency alternating current produced by a magneto generator to operate the apparatus. Thus, when it is desired to send a letter, the key is simply held down till the natural pulsation of the current has brought round the proper letter, when it is released for a moment. This method is entirely practical and well worth the trouble of constructing it. On lines running more than 100 ft. it is very desirable to use relays, as the current required to operate the letter wheels is too much to transmit any distance without serious loss in the line.—CHAS. HORTON.

Interesting Method of Learning the Telegraph Code

IN learning either of the telegraph codes one finds it easy enough to learn to transmit correctly without the aid of



A metal ball rolling in V-shaped notches having alternate contacts and insulation

any other person, but, when it is desired to learn to receive, it becomes absolutely necessary either to have a teacher or some kind of apparatus to take his place. There are very few students who can afford the services of a teacher and consequently the majority must secure some sort of mechanical device to make the signals. There are several of these devices on the market but as a rule the price is a good deal beyond reach. Furthermore, in these mechanical transmitters there is not enough of the element of chance; that is, when one has used one of these instruments for a short time he gets used to the combinations employed to such an extent that the instrument loses its usefulness.

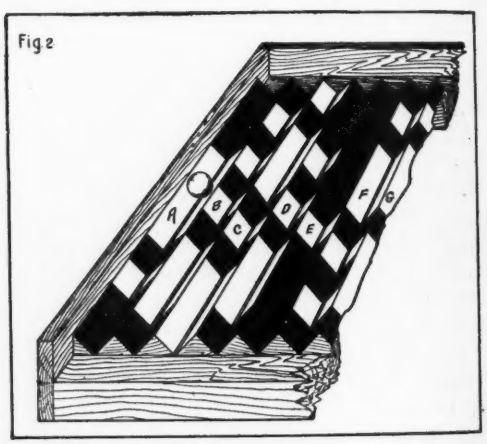
In learning the code quickly it is absolutely necessary that one never know what letter is coming next and it was to provide an arrangement in which the element of chance enters that the apparatus herewith described was developed.

Reference to Fig. 1 will serve to give an idea of the method used. The principle in use is to provide a V-shaped trough, for a metal ball to roll in, and to cover the sides of the trough with metal pads so arranged as to correspond to the telegraph signals. When the ball is caused to roll over the signals it makes corresponding contacts and a buzzer or sounder repeats them.

Thus in Fig. 1, *A* is a baseboard and *BB* are metal angles fastened to the board so as to form troughs, *CC*, between them. In each trough is glued pieces of paper or other insulation bent at right angles, as at *EE*, so arranged along the length of the trough as to form the signals. The arrangement of the parts is clearly shown in the view, Fig. 2, which is a corner of the apparatus with the cover and the front removed. It will be seen that there is provided one trough for each letter and numeral of the telegraph alphabet and the insulating pieces are pasted in to correspond to the characters forming each letter. The author uses forty characters; 26 for the letters, 9 for the numerals and 5 for punctuation marks, etc.

A cover for the box is to be made of wood or cardboard so that the ball will be prevented (when the cover is on) from jumping from one groove to another.

The simplest method of using the apparatus is to take it up with the two hands with the cover on and by tilting the box to cause the ball to roll back and forth through first one groove and then another, thus producing signals at random. It will be evident after a little thought that signals will be produced with this form of the apparatus only when the ball rolls in one direction for all letters except those which are symmetrically arranged, as for instance, *D*, *E*,



The ball may roll into any one of the notches without the operators' knowledge

etc. It will be evident to anyone with the ability to build the apparatus that a passage could be provided for the return of the ball so that meaningless signals would be prevented and also that a pivoted frame might be constructed so

that the apparatus could be worked with one hand, leaving the other free to write the characters as they are produced. It is also possible to construct the apparatus in circular form by arranging the troughs around a conical piece and have the balls pushed one at a time up through the center of the cone to fall in one direction or another down the cone and enter one or other of the troughs and then return to the passage in the center to be pushed up again. It is further evident that a magnet might be arranged in connection with the above arrangement so that as soon as one ball made a contact after finishing its character the magnet would push up the next ball. Thus the machine would be entirely automatic and the operation continuous. This arrangement would make a very effectual apparatus for rapidly learning the code.

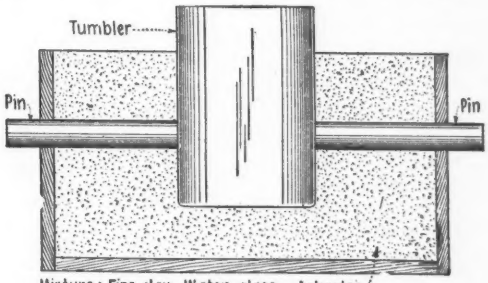
The apparatus, in order to continue to work properly, should be kept clean so that the ball will make perfect contact on the sides of the trough.

For cheap construction thin shiny tin should be used as this will not tarnish if carefully kept. A better construction is to make the angles of thin brass and have them nickel-plated. Ordinary steel ball-bearings will be satisfactory, but brass balls nickeled are better.

Home-Made Electric Furnace for Heating with Arc Light

AN electric furnace of the arc type can very easily be made by anyone from the following materials: fire clay, asbestos fiber and water glass. A mixture of these ingredients will quickly dry and harden into a fireproof mass of low heat conductivity.

To make the furnace, select a box about 8 in. long and 4 in. square. Bore a hole a little above the center of each end just large enough to take a standard lighting carbon. Then mix some of the fire clay, asbestos fiber and water glass together, until a doughy mass is obtained and pack a layer 1 in. thick in the bottom of the box, forcing it down as firmly as possible. Now insert an ordinary glass tumbler in the center of the box and two wooden pins the size of light carbons in the holes at the ends. Around these pack as firmly as possible more of the mixture, filling the box completely. Smooth off the top and fill in the small cavities with a mixture of fire clay and water glass alone. In similar manner make a cover of the same size and about 1 in. thick. Place the box and



Cross section of the box filled with the mixture around the pins and tumbler

contents, together with the cover, in some warm place, preferably on the top of a furnace, and allow them to dry for about ten days. At the end of that time the box may be broken away and the pins and tumbler removed. To improve its appearance the outside may be retouched with a little fire clay and water glass. The result is a very efficient arc furnace of practically indestructible material which can be used in series with a suitable resistance on any house lighting circuit for many experiments.

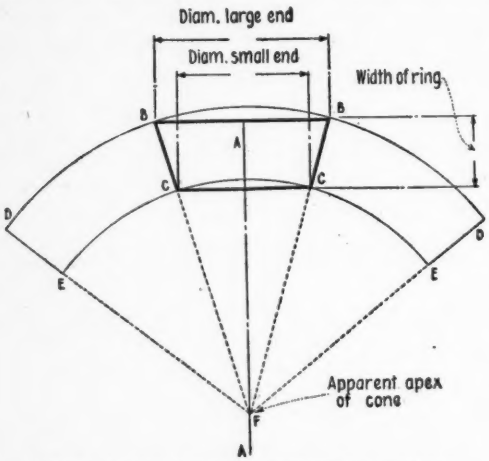
A Simple Way of Cutting Mica V-Rings to Fit on an Armature

AN armature winder often experiences much difficulty in cutting a V-ring from a sheet of mica so that it will fit properly. A simple method of getting an exact fit is as follows: We will assume that the bevel surface to be covered with mica is a section of a cone, the apex of which would extend to the heart of the shaft at a point which would be the intersection of two lines, drawn as the continuation of the beveled surface of a V-ring, toward the heart of the shaft.

First, draw a perpendicular line, *A A*, on a mica sheet. Measure diameter of the large end of the V-ring with calipers. Place the measurement line, *B B*, at right with line, *A A*, taking care that the line, *A A*, cuts the line, *B B*, exactly in the center. Next, measure the diameter of the small end, and make the line, *C C*, parallel to, and at a distance from line

B B, equal to width of V-ring. Connect lines *B* and *C* on both sides, extending lines to *A A*. Call this intersection point *F*, or "apparent apex of cone."

Using *F* as the center and *B* as the radius, describe a large arc. Repeat this operation using *C* as the radius. This gives us proper curve and width of the



Method of laying out a pattern for cutting the mica V-rings used on armatures

mica V-ring, but to eliminate waste the length should also be known; the exact length is not needed and would be impractical for two reasons; first, it would involve too much figuring for the average armature winder and take up too much time; second, because provision must be made for welding mica V-ring ends together.

Therefore the exact length would be too short. To get the required length, encircle the large end of a V-ring with a piece of banding wire, allowing an extra inch for welding. Set this measurement on the large arc, and mark off the points, *D D*. Connect points *D D* with the apex, *F*. The V-ring is now all laid out and ready to cut.

A Holding Clip for Making Tests on Spark Plugs

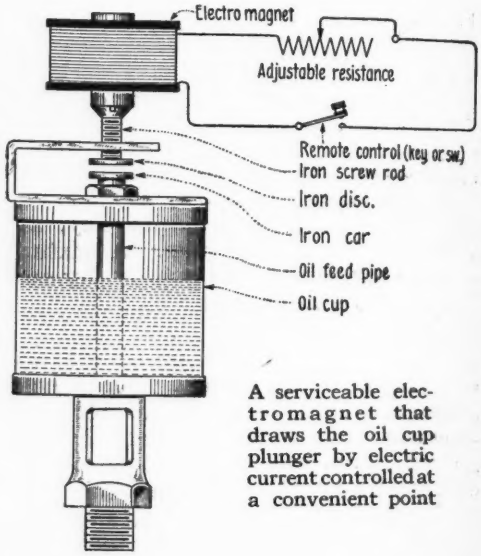
WHEN testing the spark on a set of exposed sparking plugs most car owners feel the need of special clips to grip the plugs, which have a habit of tumbling out of contact, more particularly when single plugs are being tested with the engine running. Under these circumstances, too, there is a risk of straining the magneto or coil if a plug swings past its wire without a ground. An ordinary bicycle pump clip of the double spring type makes an excellent plug holder. One end may be sprung over any convenient pipe or bolt and the inverted plug dropped into the empty end.

Controlling an Oil Cup by Means of an Electromagnet

THE magnetically operated oil cup described herewith will be found to be a very convenient means of controlling oil feed in partially inaccessible places.

An electromagnet is used in this scheme, as shown in the sketch. To open the oil cup, energize the magnet by control switch or push button. The iron disk, adjacent to the electromagnet, becomes magnetized and draws up the iron cap on the top of the oil feed pipe, and the oil will commence to drip. Upon breaking the circuit, the disk is demagnetized and the oil feed pipe, being no longer attracted, again falls and closes the feed hole.

Regulation of the flow can be obtained by adjustment of the iron disk, which is



A serviceable electromagnet that draws the oil cup plunger by electric current controlled at a convenient point

connected to a screw rod, as shown. A small electromagnet and a rheostat in series in the circuit will render the control of the oil cup quite precise. This device has considerable worth.—PETER J. M. CLUTE.

Wireless Work in Wartime

XI.—Radio transmitters using synchronous and quenched gaps

By John V. L. Hogan

IN last month's article the non-synchronous operation of a rotary gap in the wireless transmitter of Fig. 41 was decribed, for conditions which gave two or three sparks for each half-cycle of alternating current power. The curves of condenser discharge are shown in

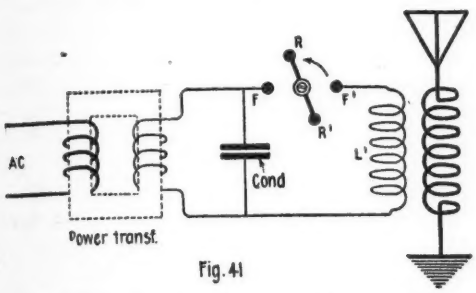


Fig. 41

A diagram of a radio transmitter with a rotary spark gap interposed in the apparatus

Fig. 42, where the divisions along the horizontal line represent six-hundredth parts of a second. Since the dashed wavy line shows the voltages at which the gap will permit a spark to jump, as time goes on, and the solid wavy line indicates the potential available (in the condenser) to produce a spark, it is evident that the discharge must pass whenever the two curves cross.

If we now adjust the studs so that they are somewhat nearer together, permitting the spark to pass at a lower voltage (or if we raise the maximum charging potential to a higher value), it is clear that the overlaps will occur more often and that it will thus be possible to secure four sparks in each half cycle of charging current. By proper selection of the break-down and charging voltages, by changing the wave-form of the charging voltage, and by using a power transformer which will put energy into the condenser quickly after each spark passes, it is possible to get a large number of fairly regular sparks per second with only a low frequency of alternating current power. The curves of Fig. 42 are not complete, since the secondary condenser voltage will be bound to be reduced by the withdrawal of energy for each spark; nevertheless, a sufficiently "quick" or closely-coupled power transformer will build it up again before the next sparking time, so that the general conditions will be as indicated.

For every spark there will of course be produced a group of radio frequency alternating currents in the oscillation circuit. With the non-synchronous method of operation these will not be of the greatest power obtainable from the same amount of input energy. This is because the condenser is not discharged at the instant it has been filled to its fullest (maximum potential) point for each spark. It has been pointed out that for a given capacity, the amount of charge depends upon the potential; obviously, then, if the condenser is discharged through the spark gap at a voltage of 7500 there will be less energy for conversion into oscillations than if the charge is held until the full potential of 10,000 volts is reached. The greatest utility of the non-synchronous method lies in the fact that with it one is able

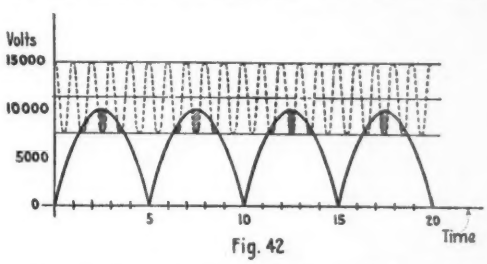


Fig. 42

Curves showing the operation of the non-synchronous spark gap for a wireless set

to secure a fairly good and moderately high-pitched spark tone from low frequency alternating current, even though at some sacrifice of conversion efficiency. By adjusting the gap for best regularity of operation, with the fewest possible

"missed sparks," a clear chord-like tone is developed. This tone, when heard at a receiving station, is much easier to read in the presence of strong atmospheric disturbances than is the low frequency rattle produced by 60 cycle current and a fixed simple spark gap, such as shown last month, and the increase in signalling effectiveness thus gained more than compensates for the loss in conversion efficiency.

Operation of the Synchronous Gap

What would happen if the rotary gap were slowed down until only one spark could pass per half-cycle of condenser voltage? This will depend mainly upon two factors: first, the instant at which the minimum break-down potential of the gap occurs, with respect to the condenser voltage curve, and, second, the value of the minimum break-down potential for which the gap is adjusted. To get the best results, the gap should reach its break-down point just at the instant the condenser reaches its maximum charge, as shown in Fig. 43. Here the dashed line again represents break-down voltages, and it is seen how the gap reaches its favorable position for sparking just as the condenser secures its maximum charge. To maintain these conditions it is necessary to mount the rotary gap element directly upon the shaft of the generator which produces the alternating current for the power transformer, so that the time-relation between the two variables will be strict and unchanging. A careful adjustment must be made, by moving the fixed electrodes backward or forward around the circumference of the gap, so that the shortest gap length occurs just when the condenser is ready for discharge; otherwise no spark will pass, or else only part of the energy will be drawn from the condenser at each discharge. This method of working is called the synchronous discharge, since the applied voltage and the gap-discharge voltage vary automatically together or synchronously. It provides what is probably the best method of securing maximum power together with a spark regularity so perfect that a clear musical spark tone is had at any frequency. To get high pitched spark tones, however, a fairly high frequency alternating current must be used, since there is only one spark for each half cycle. Thus a 500 cycle current, as shown in Fig. 43, will produce a spark tone of 1,000 impulses per second. As before, each discharge generates a group of radio frequency oscillations in the primary circuit consisting of the condenser, spark gap and inductance L_1 (of Fig. 41).

It should be noted that in general the non-synchronous method of operation involves the use of a rotary gap driven by a separate direct current motor without any particular relation to the input frequency, and that the sparking and missing times occur at random. In Fig. 42 is shown a perfectly adjusted relation

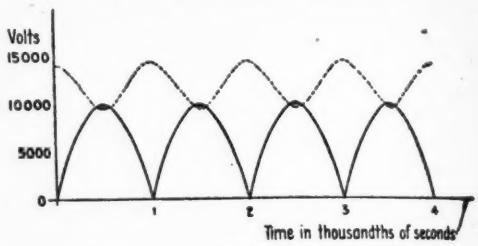


Fig. 43

Break-down point should be reached when the condenser reaches the maximum charge

between the gap frequency and that of the applied current which is almost impossible to hold in practice, although it may often exist for short times. With the separately driven gap it is possible to slow down the discharge frequency until it is exactly twice that of the applied alternating current power, and so to approximate the synchronous discharge condition. It is impossible to maintain the instant of discharge correctly in phase (or in step) with the power current in this way, however, and consequently for best synchronous operation, the direct mechanical connection of the rotary gap and the generator, must be relied upon.

Construction of the Quenched Gap

A fourth type of gap, shown in Fig. 44, is largely used in spark transmitters. This usually consists of highly cooled enclosed parallel sparking surfaces, often of silver, which are mounted in pairs and separated only about 1-100 in. The sparking potential of such a gap unit is about 1,000 volts, and to build up the breaking-down potential to a higher value

a number of the units or pairs are connected in series. This construction has received the name of "quenched gap," since when it was first used it was presumed to have an especially effective quenching or extinguishing action upon the spark passing across it. The quenching action is now generally held to be more dependent upon the correlation of circuit adjustments than on the gap structure itself, however, as will be explained later, and the gap is merely one form of device which is capable of giving extremely uniform operation. This regularity of operation depends largely upon the fact that the current through the gap is kept small, and the surfaces are kept clean and parallel, so that successive discharges take place from different portions of the discharge plates. Thus extreme heating of any one point is prevented, and the gap may be relied upon to discharge at a quite definite potential time after time.

The basic operation is exactly as in all the other spark gaps considered. The construction shown in Fig. 44 involves plates having cooling flanges, separating feet and the silver sparking surfaces indicated respectively by *F*, *G* and *H*, which are placed face to face (spaced accurately by the insulating gaskets *I*) in pairs as shown. The entire group of from six to thirty or forty units is clamped together in a special form of rack.

This quenched gap is connected into the normal circuit of Fig. 41, replacing the rotary gap there shown. For best operation it requires a circuit adjustment somewhat different from that used with the rotary gap, since with "quenching" operation the endeavor is to transfer the energy of the radio frequency oscillating currents across the transformer with primary L_1, into the antenna circuit, in the shortest possible time. Under these conditions, the gap discharges so regularly that a pure musical signal tone is heard at the receiver. The technical differences between so-called "quenching" and "non-quenching" operation may be understood from a study of such authoritative treatises as Zemeck's "Wireless Telegraphy"; the principles given in the foregoing are sufficient to bear in mind during the first survey of the action. The war-time student requires only such a grasp of the general subject of radio as will permit him to get into practical field work at the earliest moment.

Production of Radio Waves

The oscillating currents of the condenser circuit (Fig. 41) are transferred into the antenna and ground circuit by the transformer action of coil L_1 upon its secondary. Similar radio frequency currents are consequently generated, in groups, in the aerial wires which stretch upward to the mast top. These antenna currents result in the production of radiant ether waves of the same radio frequency. The wireless waves pass outward over the surface of the earth, in all directions, at the speed of 186,000 miles per second; some small portion of the radiated wave energy reaches the receiver to which the messages are sent.

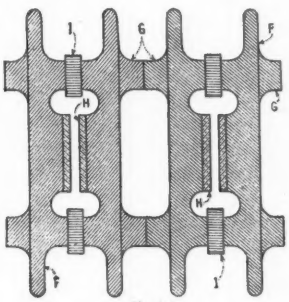


Fig. 44

Separating feet and sparking surfaces

The closing articles of this series will take up the interception of the radio waves at the receiving station.

Mind Reading by Wireless—Try It on Wise Friends

THE mind reader bounds up every few months. The feats he can perform are little short of marvellous. William Dubilier of New York has given the following details to the POPULAR SCIENCE MONTHLY of how many of these mind readers work. Any wireless enthusiast can set up equivalent apparatus and obtain equally good results.

Dress yourself or a friend up as the mind reader. Oriental costumes are all the style in the mind-reading profession, and in this case are especially necessary because a Turkish or Indian turban makes an excellent headpiece by which the mind reader can conceal a pair of telephone receivers clamped to his ears. Around his body just beneath the shoulders are wound some 100 turns of No.

30 double cotton-covered copper wire, the ends being directly connected to the receivers. All wiring is of course concealed by the mind reader's cloak, his turban, and perhaps a high collar of some sort around his neck. Wired up in this way, the mind reader is ready for action.

But the mind reader must have an accomplice. The idea is that some member of the audience before which exhibitions are given be requested to show something to this "friend" (the accomplice), whereupon the mind reader will tell what it is. For instance, the "friend" may be shown a watch, and the mind reader requested to tell what time it is. Or perhaps the object exhibited happens to be a newspaper and the person with occult powers is asked to tell what headline the exhibitor has his finger upon. Many such tests can be devised.

Around the accomplice's body just beneath the arms, in the same way as in the case of the mind reader, are wound about fifteen turns of No. 16 double-cotton-covered wire. This serves as a sending "aerial," while the turns on the mind reader serve as a receiving "aerial." As shown in the diagram, the turns of wire on the accomplice are in series with several cells of flashlight battery concealed in some manner on his person.

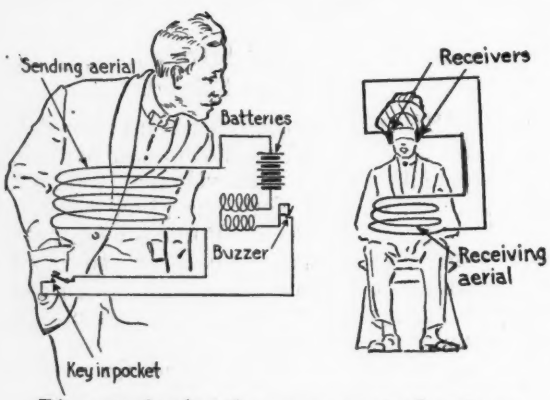
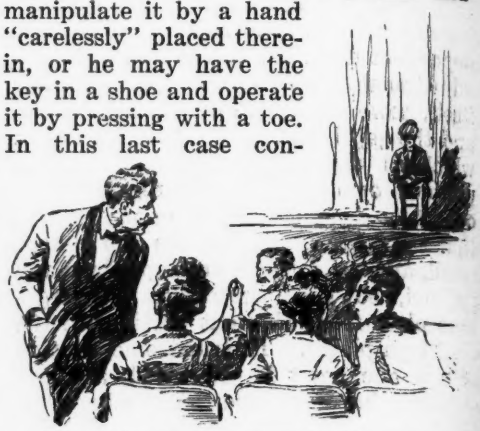


Diagram showing the arrangement of parts on the body for mind reading sending and receiving

Also in the circuit are a key and a small, almost-noiseless buzzer, likewise concealed.

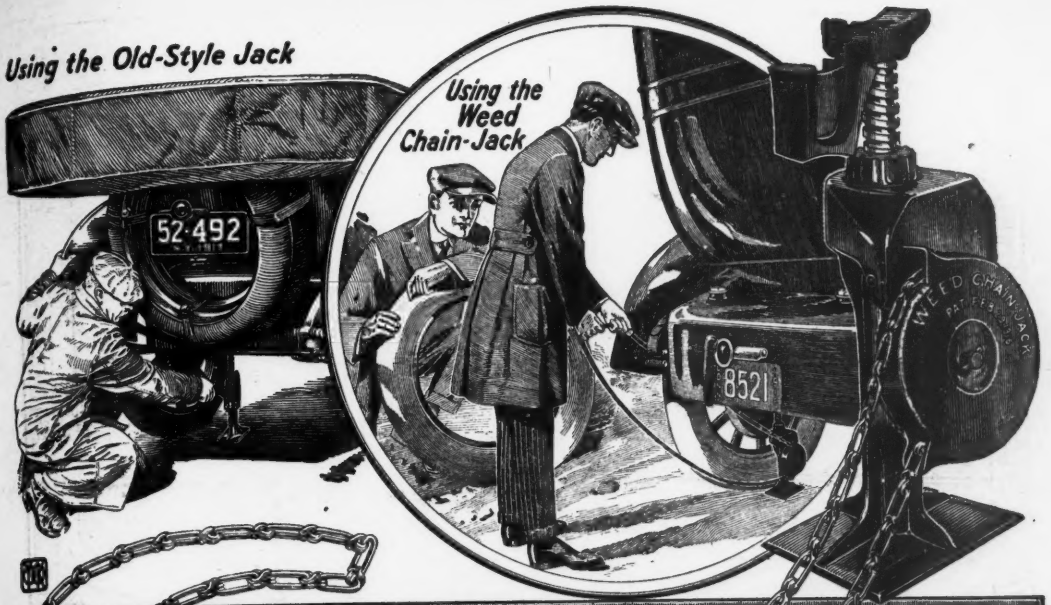
When the person who sets out to test the mind reader's powers holds something up before the accomplice, the accomplice of course reads it, or otherwise notes what is necessary, and telegraphs the information to the mind reader over the miniature, short-range wireless just described. The accomplice may have his key in a coat or trouser's pocket and manipulate it by a hand "carelessly" placed therein, or he may have the key in a shoe and operate it by pressing with a toe. In this last case considerable skill is necessary, but by diligent practice professional accomplices sometimes attain great proficiency.



The audience being entertained by a seemingly miraculous way of mind reading

The accomplice may wander anywhere about the room, wherever he may be called, in fact, by those who desire to test the mind reader's powers. Still the wireless works regardless of the changes in position. By pretending that peculiar psychopathic influences exist between accomplice and mind reader, the illusion may be heightened. The audience will wonder how any two persons can carry on thought transference to any such great extent. Yet the initiated wireless man knows!

While the amateur is now barred from using his wireless instruments, this idea presents a new and interesting way of making use of parts of his apparatus and of keeping in practice in sending and receiving. It also provides entertainment for his friends. The apparatus is not difficult to construct and it may be used many times in school work or for private theatricals as a paramount feature for the evening entertainment. Amateurs who have put the idea into execution are enthusiastic regarding it.



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To operate a Weed Chain-Jack it is not necessary to get down in a cramped, strained position and grovel in the mud, grease or dust under a car to work a "handle" that is apt to fly up, with unpleasant results. ***To lift a car*** with the Weed Chain-Jack, simply give a few pulls on its endless chain while you stand erect—clear from springs, tire carriers and other projections. ***To lower a car*** pull the chain in opposite direction. Up or down—there's no labor.

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The 8 inch and 10 inch sizes are made with an auxiliary step as illustrated above. When in operative position this step adds two inches to the height of the jack.

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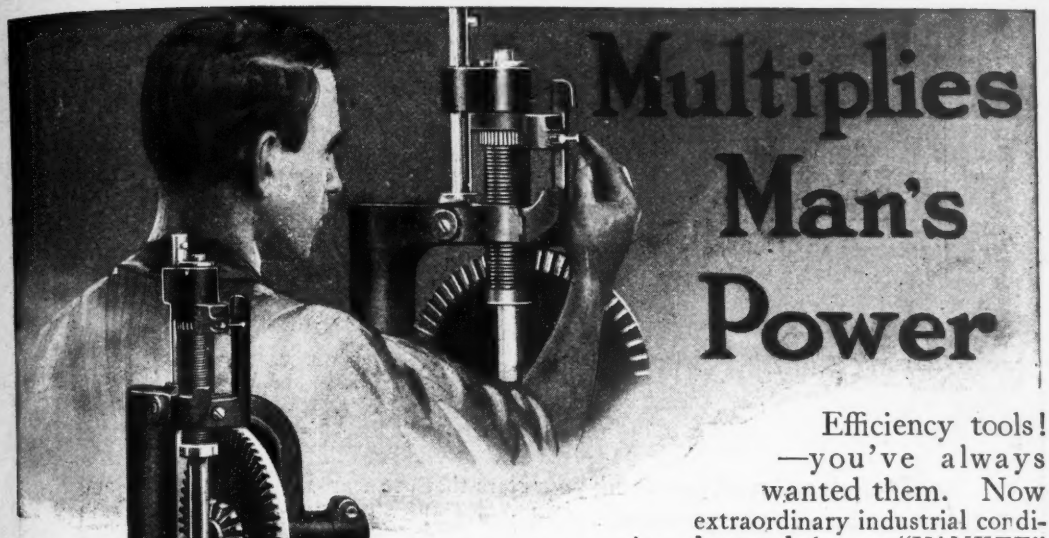

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The 1918 line of Indians offers a type and model mount for everybody at prices that meet every present-day demand. It embraces the Indian Big Twin, Side Car, Light Twin, Parcel Car, Electrically Equipped Bicycle, and twelve other model Bicycles.

Illustrated 1918 Motorcycle or Bicycle Catalog sent on request

Hendee Manufacturing Company

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Largest Motorcycle Manufacturers in the World

Nine o'clock and no washwoman yet!

IS washday the big problem of the week in your home? It need not be. You can solve it as well as your servant problem by using the

Western Electric
Washer and Wringer

It does the hard work. It washes the clothes in a revolving cylinder of hot suds so that there is no wear or tear on them, and it does it all at a cost of about 3 cents for the average family's wash.

With the Western Electric Iron to help, the ironing is quickly and pleasantly done, while the Western Electric vacuum cleaner, portable sewing machine and other household appliances all help you manage your home in an up-to-date business fashion.

Let electricity help you meet your particular problem this summer. Ask for Booklet No. 21-AT

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Made by Sanford Mills

Has the same rich appearance of costly leather and retains its first beauty after the hardest wear.

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This is the worth while upholstery material for motor-cars, passenger or trucks. *Write for Samples.*

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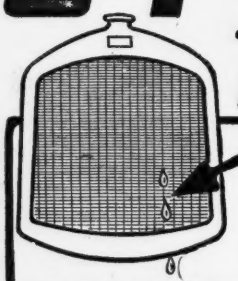

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Just a little more fuel—and you'd have made it. But that "little more" was lacking and you were stuck.

The New Stromberg Carburetor

—goes further than supplying that "little more" gas. It leaves a lot *after* the amount you *now* use is consumed. It insures the longest run for your fuel money—most miles per gallon. Saves money on every mile your car covers—savings that are too important to be overlooked by *any* motorist. Write for Free Literature. Give name—model and year of *your* car.

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2 distinct sparks with the same "juice" ordinary plugs use

Think of the added power your motor would have if equipped with Twin Fire spark plugs. Each combustion complete—less carbon, less trouble with pumping oil, and with the same current ordinary plugs use.

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Has two spark gaps. If one clogs the other continues firing and the hot explosions soon clean the fouled point (not so with any other plug on the market). This is possible because with Twin Fire the current is used twice—you are always sure of a hot spark. Ask your dealer or order direct—the price is only $1.00.

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YOU take no chance in ordering BUCKSKIN Tires by mail because we send them on a money-back guarantee. And they save you from *$20 to $60 a set*, depending on the size and make you now use. They're guaranteed to give 4,000 miles hard service, though many users get 8,000, 9,000 and 10,000 miles. We also repair all BUCKSKINS *free* at any time, no matter how far they have been run.

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MINUTE WHEEL

DEMOUNTABLE

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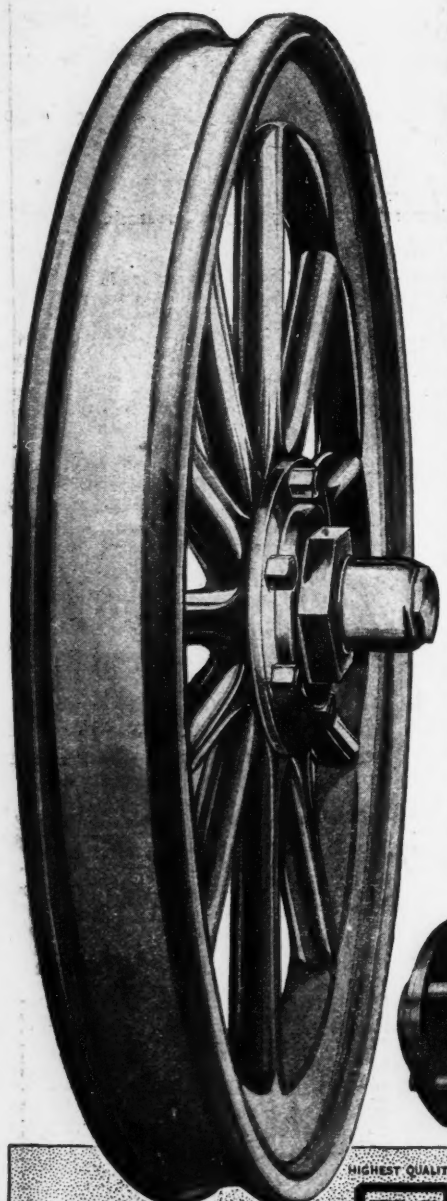

A tire changed in 60 seconds—One nut to unscrew, that's all you do

DRIVE, this Summer, free from tire changing annoyances. Carry your spare tire on the Minute Demountable Wheel.

You'll get more mileage out of your tires.

No mud encrusted rim to pry off. No more soiled hands, wilted collar, ruffled temper or lost time.

The Minute Demountable Wheel is backed by the H. S. Trademark of quality. Thousands now in use.

Equipment consists of extra wheel, interchangeable front or rear—four hubs to replace present Ford Hubs. You use the Ford Wheels. Simple to install.

A quick tire change to meet the needs of doctors, women drivers, owners of Ford delivery fleets, every alert Ford owner.

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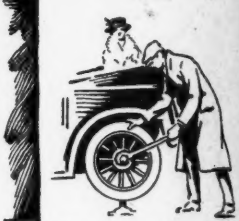
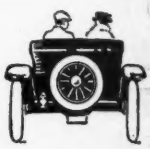


OFF WITH THE WHEEL



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IT TOOK ONLY A MINUTE!

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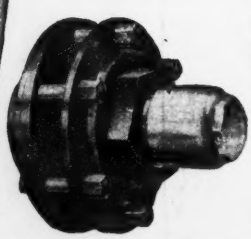

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REPAIR PARTS FOR THE FORD AND OVERLAND CARS

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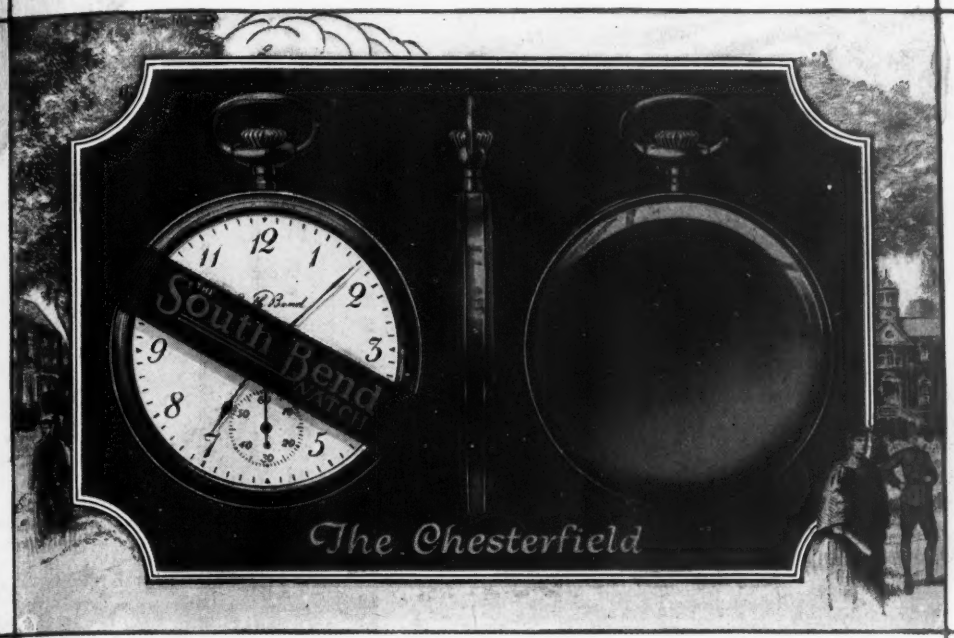

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There are other Chesterfield models, also, at almost any price you wish to pay. All are *Extra-Thin*, stylish and handsome; and all are dependable timekeepers.

See them at your jeweler's. "A Book of Beautiful Watches" will be sent you on request.

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The Watch with the Purple Ribbon

—the symbol of perfect writing, the mark of the Eversharp Pencil and Tempoint Pen.

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Here are the world's two most famous writing points, the efficiency ends of the Eversharp Pencil and Tempoint Pen.

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—the point of this fountain pen has a steel-like hardness and flexibility—unaffected by hard use or ink acids. Famous Wahl Comb Feed insures exact flow of ink. Air-tight chamber prevents "sweating" and keeps pen moist for instant writing. Made in both Self Filling and Screw Joint styles. (Heretofore known as the Boston Safety Pen.)

Both Pencil and Pen are made for pocket, chain, or lady's handbag. Pencil prices, $1 and up. Pens, $2.50 and up. At better dealers everywhere. Or, write for descriptive literature to aid in selection direct.

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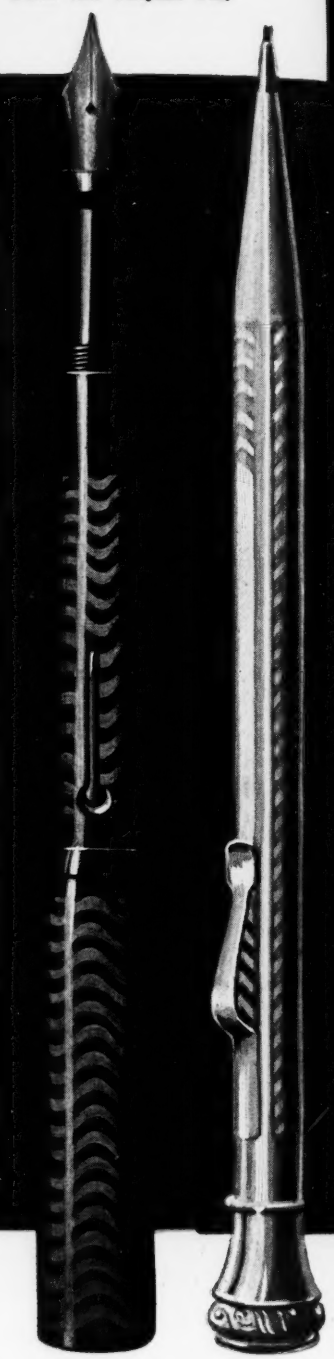

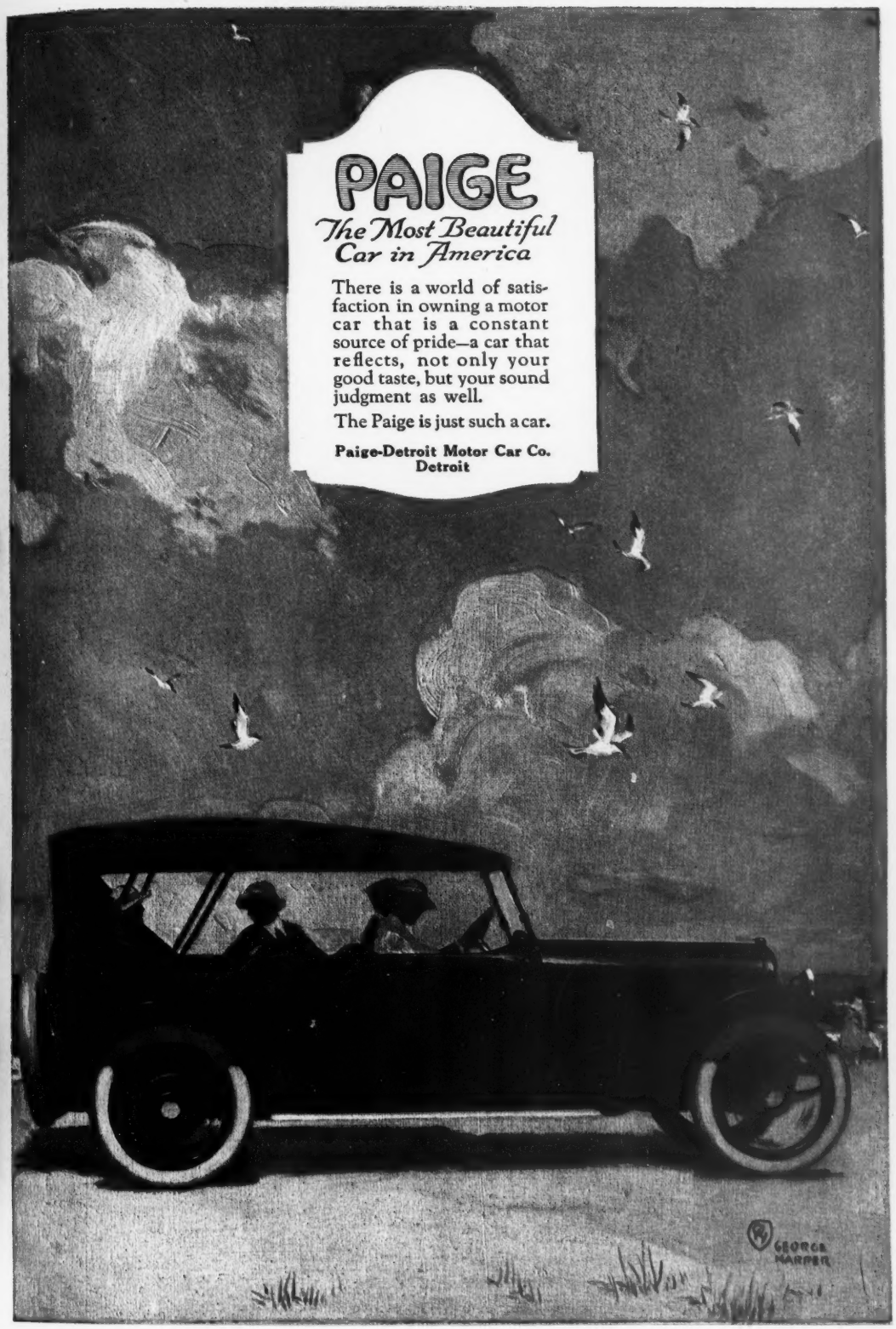
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The Paige is just such a car.
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Red Wing
Bavarian Cream
½ pint Red Wing Grape Juice.
½ pint boiling water.
1 package Jiffy-Jell (omitting separate vial of flavor).
1 cup heavy cream
Dissolve Jiffy-Jell in boiling water, and add the Red Wing Grape Juice. When mixture has commenced to thicken, fold in the cream, whipped stiff. Pour into mold, and let stand a few hours until solid.

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Here is a simple Red Wing Dessert that will prove the quality and economy of this delicious, full-flavored Grape Juice. Try it.

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That is why Red Wing retains its richness, flavor, body and color even when appreciably diluted. When you want *real* grape juice ask for Red Wing.

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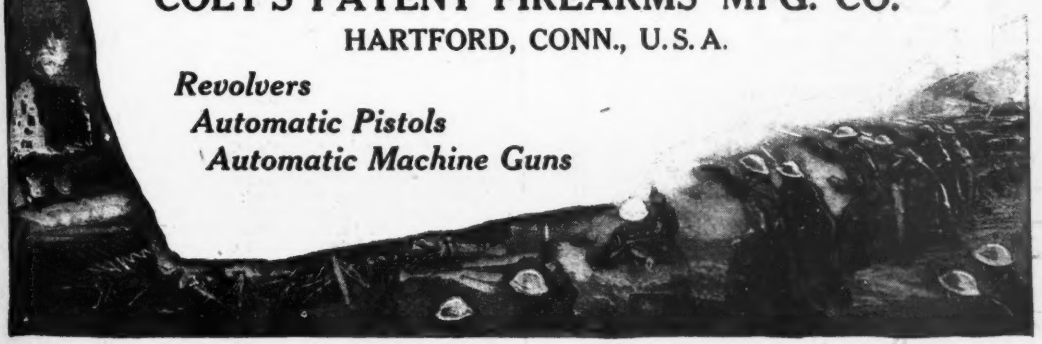

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Throws a Piercing Beam of Light 500 Feet

Cell-Beam CONCEALED SPOTLIGHT

Operates from a storage battery, set of dry cells or magneto of a Ford. Attaches to instrument board or drops into door pocket. Weighs less than a pound. Equipt with 30 C. P. Nitrogen bulb. A Spotlight, Searchlight and Glorified Trouble Lamp rolled into one. You need one on your car or boat. Order one to-day. No risk to you. Read the Coupon.

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LOOK! See that groove controlling the oil? The groove full of oil forms a dam. Gas cannot get down, surplus oil cannot get up. That's why motor has more power, no carbon. ISN'T THAT A REASON?

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The prong is made of beautiful metal; never break nor wear out; scientifically made and best workmanship. Finest pair of rubbers you ever saw; they are made for this purpose and are more elastic and lasting than any others.

Zip-Zip complete with several rounds of ammunition, all for 50 cents.

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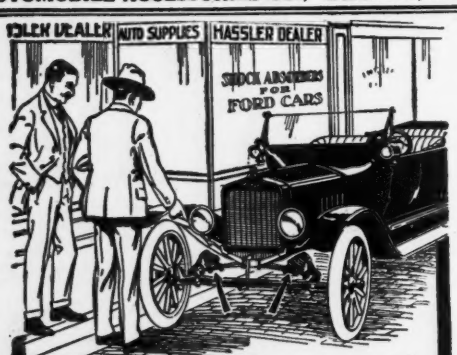

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If you are willing, we will take them back without question when the ten days have elapsed. But you won't bring them back.

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Hassler Shock Absorbers pay for themselves over and over again. Reduced tire bills, more miles per gallon of gasoline, one-third up-keep cost saved—all swell the total of Hassler dividends. 300,000 Ford Owners recognize their economic necessity. Write today for Free Trial Blank, illustrated circular and opinions of users.

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SOFT AND RESILIENT ACTION REBOUND
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1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, The Modern Publishing Company, Inc., 225 West Thirty-ninth Street, New York, N. Y. Editor, Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y. Managing Editor, Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y. Business Manager, O. B. Capen, 225 West Thirty-ninth Street, New York, N. Y. 2.—That the owners are: The Popular Science Publishing Company, Inc., 225 West Thirty-ninth Street, New York, N. Y. Stockholders of Popular Science Publishing Company, Inc., Henry J. Fisher, 22 William Street, New York, N. Y.; Oliver B. Capen, 225 West Thirty-ninth Street, New York, N. Y.; Robert Cade Wilson, 683 Springfield Ave., Summit, N. J., Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y., George B. Agnew, 22 William St., New York, N. Y., Susan D. Bliss, 22 William St., New York, N. Y. 3—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: Importers and Traders National Bank, 247 Broadway, New York, N. Y.; H. J. Fisher, 22 William Street, New York, N. Y.; S. D. Warren and Co., 200 Devonshire St., Boston, Mass.: 4.—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) O. B. CAPEN, *Business Manager.*

Sworn to and subscribed before me this 18th day of March, 1918.

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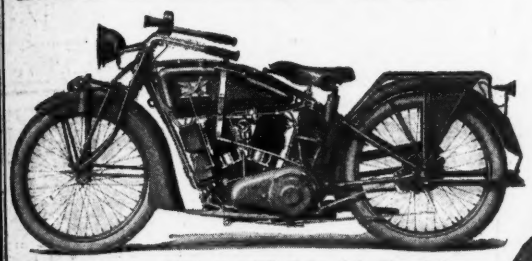
Pigs are Pigs and all pretty much alike, but it is the exclusive details in design and construction that put one motorcycle far above all others of its type in the qualities that insure service and satisfaction.

EXCELSIOR — HENDERSON



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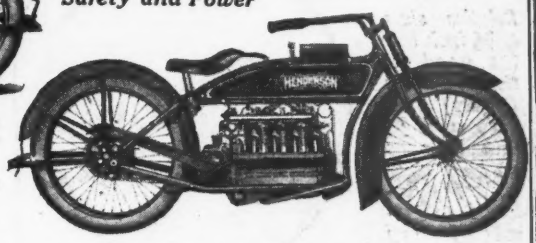
The Aristocrat of Motorcycles, combining the utmost of Luxury, Comfort, Safety and Power



The big Twin Military Model with Excelsior Kushion Sprocket, Double Trussed Military Front Fork, Automatic Compression Control, Entirely Enclosed Clutch, and Motor Drive Chain, Cushioned Pinion Motor Starter, Open Bottom Frame with Removable Center Bar, and other valuable features, all exclusively EXCELSIOR.

Bear in mind. We also build the **Excelsior Side Car** to fit both **Excelsior** and **Henderson** and the **Excelsior Lightweight,** the safest and most economical motorcycle for general utility ever made.

Write for Catalog, or see the Dealer.

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FREE JUST OFF THE PRESS

THIS 100-page **FREE** Book will be the 1918 Auto Supply Show for over 2,000,000 motorists. Contains many brand new supplies. **Over 2,000 selections to choose from.** Sit in an easy chair and do your buying. Everything from bumper to tail light. Twenty pages exclusively for Ford Owners. **Always refer to it before buying. Write right now for your FREE copy to nearest store.**

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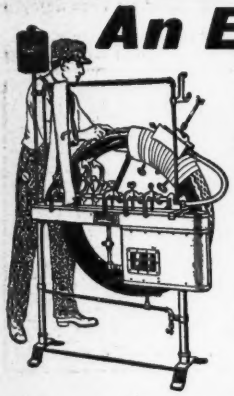
The Old Reliable 25¢ a tube
BUFFALO SPECIALTY CO. Buffalo, N.Y.

An Easy Way to Make Money



Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business and make $60 or more a week. One man made $45 the first day he received his outfit. **Others are making $25 a day and hundreds of wide-awake men are making $200 to $500 a month.**

No experience needed. We teach you how. Very little capital required. But slight risk, as every car owner in your town is a possible customer. Jobs are plentiful because tires blow out and puncture every day.

SHALER Tire Repair Outfit, $70

will do as much and as perfect work as the big $250 to $500 vulcanizing outfits. A boy can vulcanize perfectly with this simple machine. It's the only vulcanizer that has **Automatic Heat Control.** It must vulcanize just right. It can't undercure or overcure a tire. Requires no watching or regulating. You can learn to do expert tire vulcanizing in half an hour with the Shaler.

WRITE FOR FREE BOOK **"HOW TO OPEN A TIRE REPAIR SHOP"** and complete Catalog, which gives full information.
WRITE QUICK BEFORE SOME HUSTLER GETS AHEAD OF YOU.

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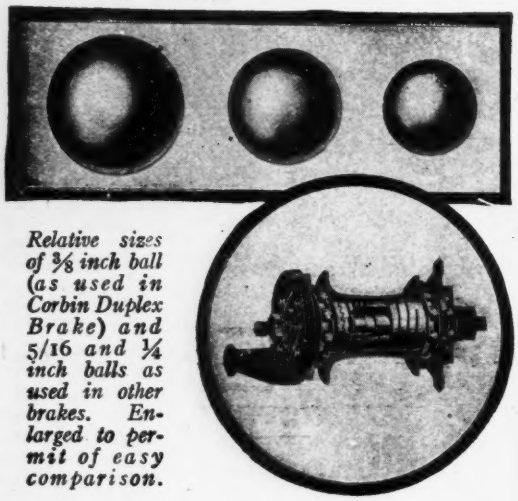
Why Corbin Control Means Safety Assured



Relative sizes of ⅜ inch ball (as used in Corbin Duplex Brake) and 5/16 and ¼ inch balls as used in other brakes. Enlarged to permit of easy comparison.

THE Corbin Duplex bicycle brake is built oversize at every point where strain or wear is to be expected. An excellent proof is found in the size of the balls used.

This oversize policy is expensive for the manufacturer, but the best for you. It guarantees safety, comfort and long wear.

The bicycle, because of its economy and great utility, stands higher than ever before in the esteem of the nation, and the Corbin Duplex brake has helped to place it in that position.

In ordinary service slight pressure stops your bicycle slowly; in an emergency, harder pressure stops it instantly.

All riders who use their bicycles for every-day business or pleasure service need the Corbin Duplex. When purchasing a bicycle specifying the Corbin.

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CORBIN SCREW CORPORATION

American Hardware Corporation, Successor

202 High Street, New Britain, Conn.

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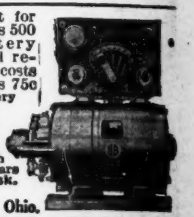

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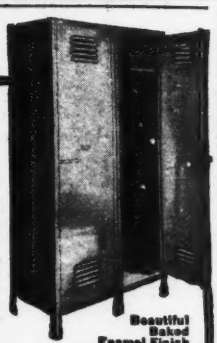

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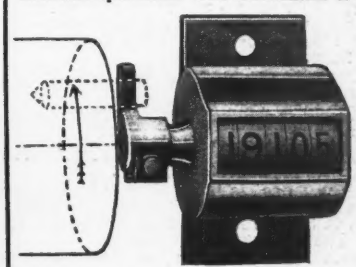

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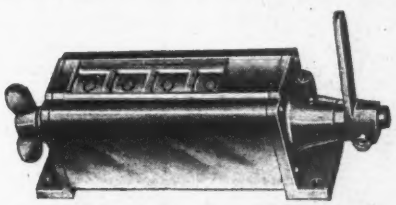

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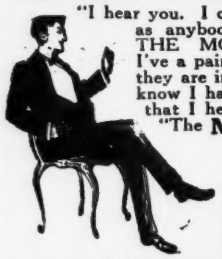

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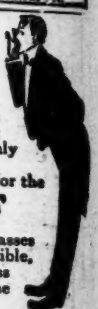

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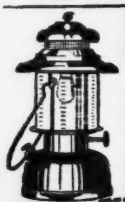

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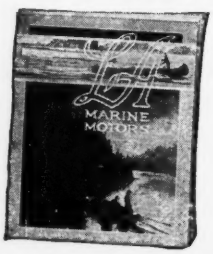

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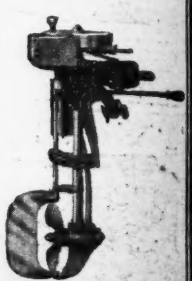

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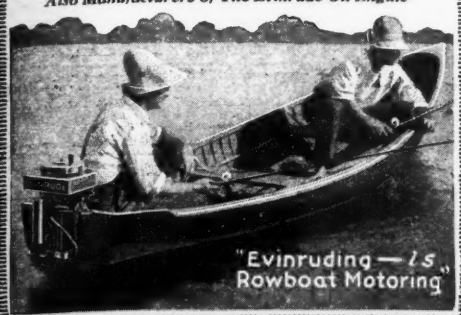

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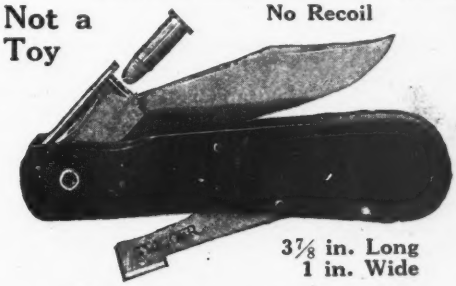

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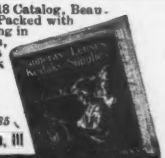

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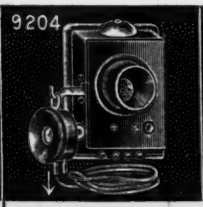

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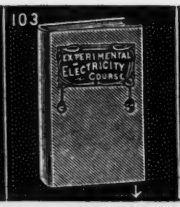

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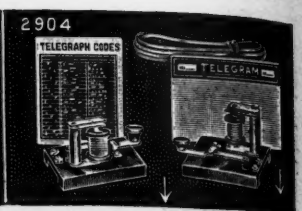

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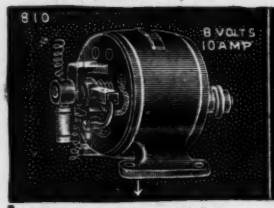

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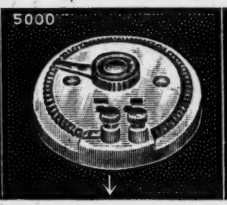

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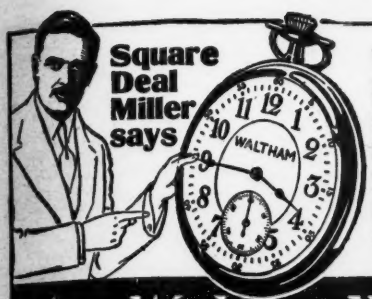

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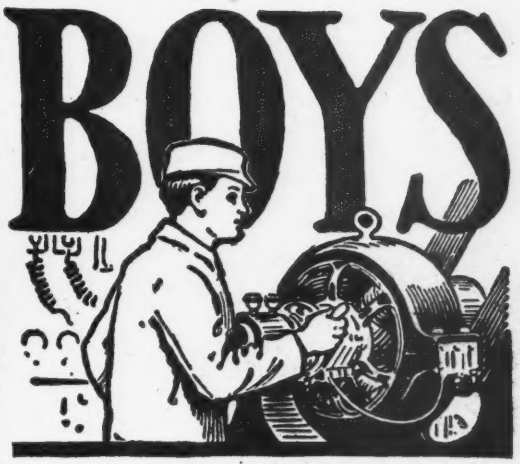

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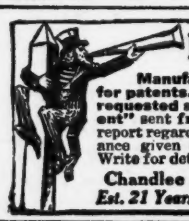

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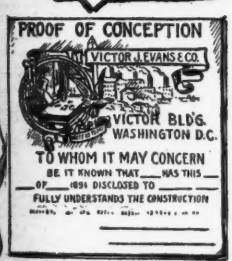
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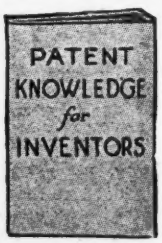

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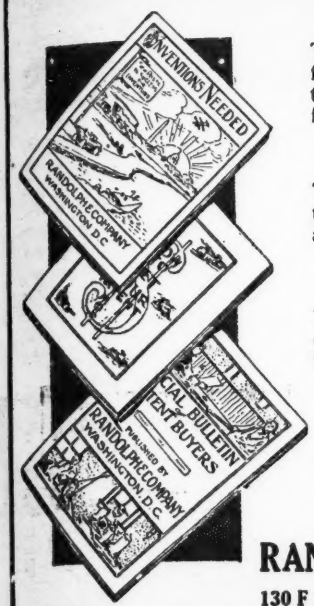

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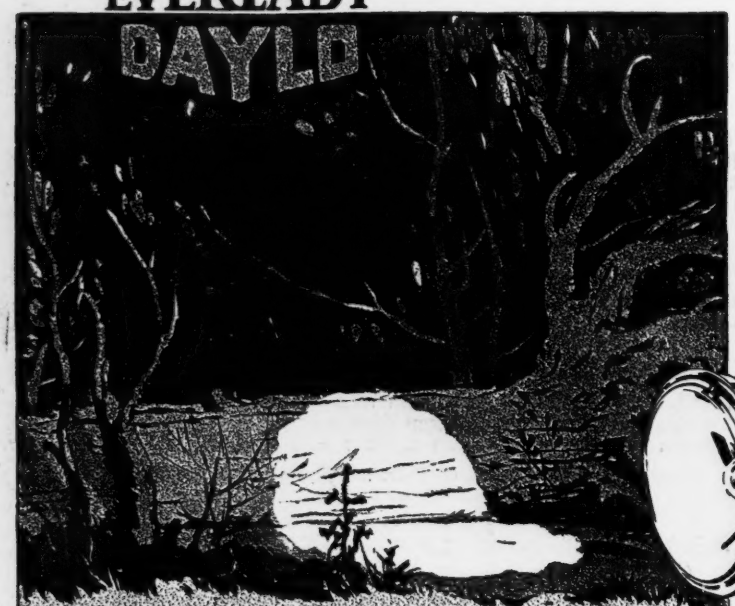

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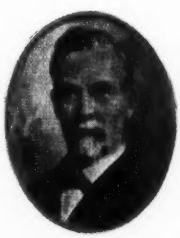

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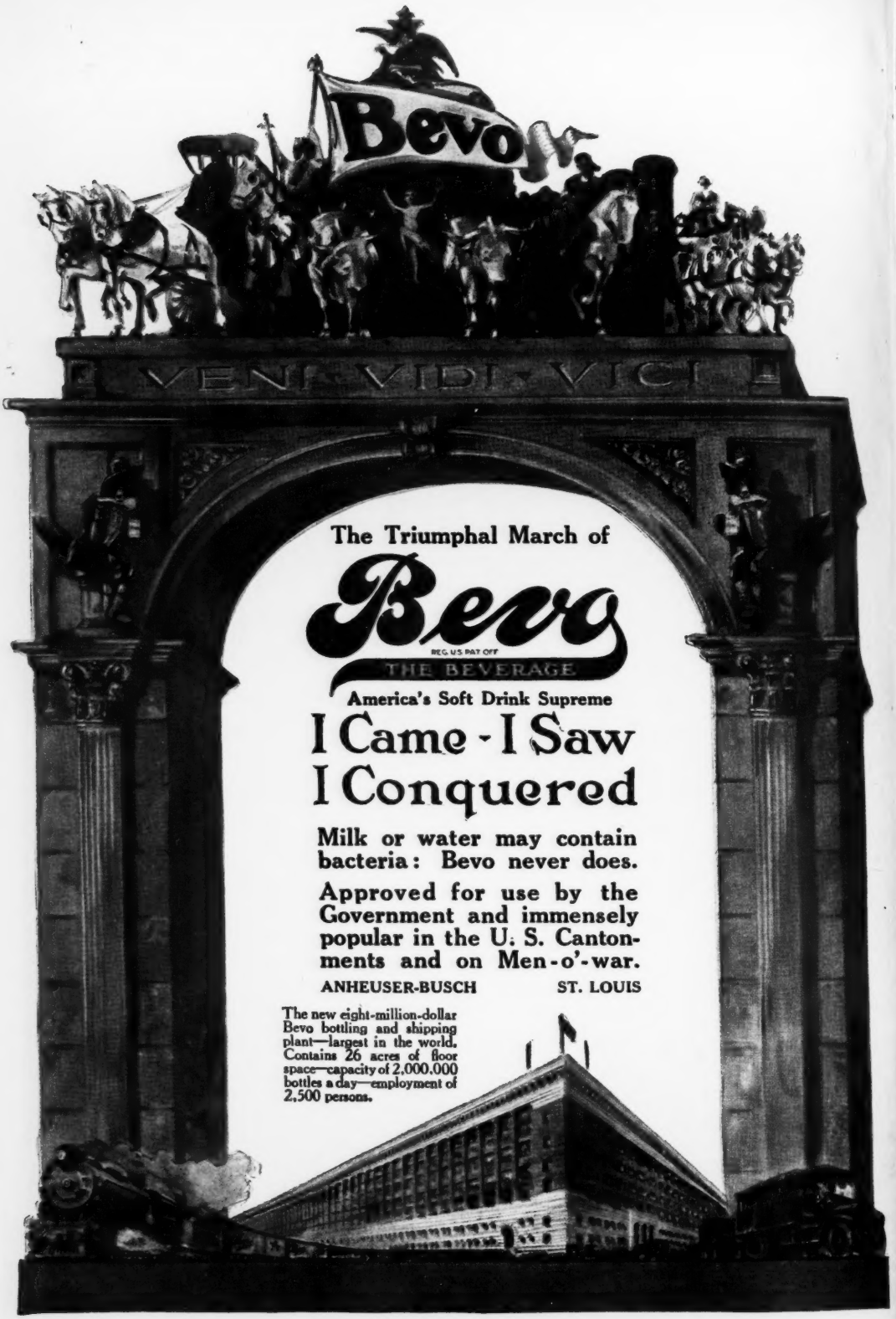

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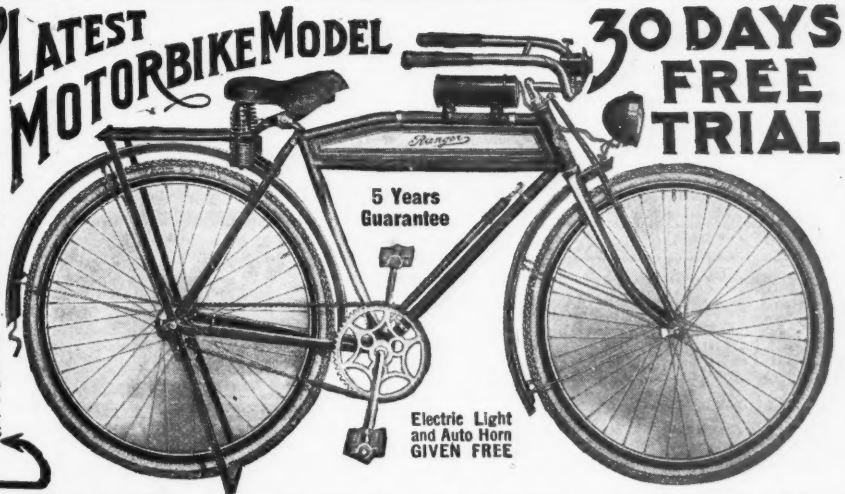

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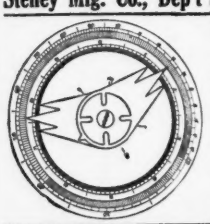

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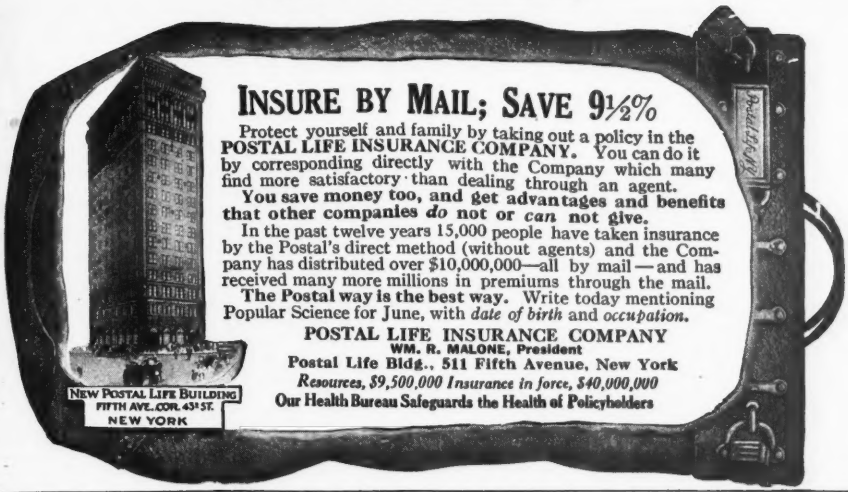

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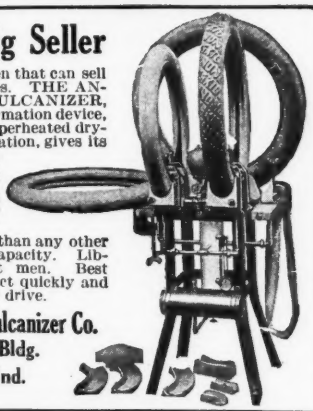

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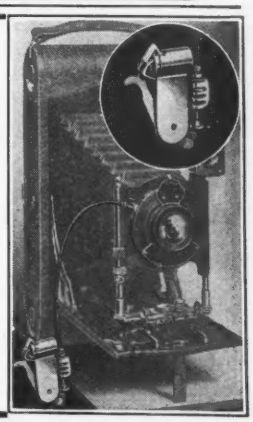

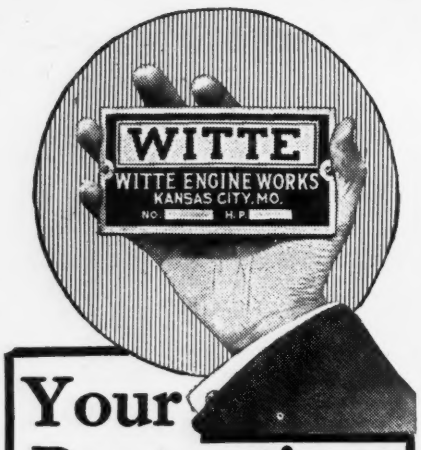

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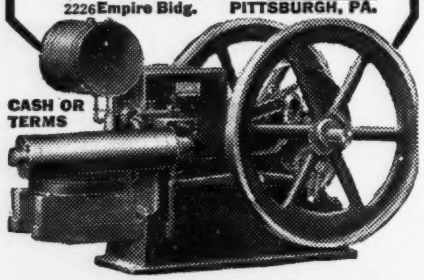

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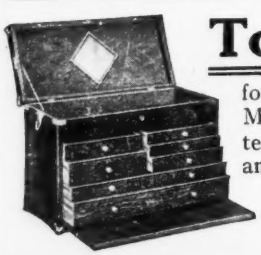

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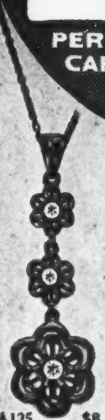

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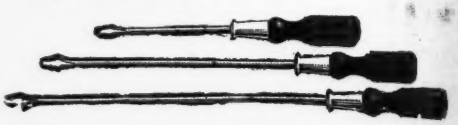
Stanley Tools



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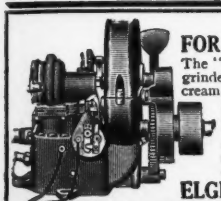

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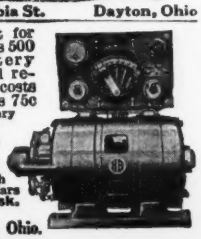

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The Oliver Typewriter

WAS $100

NOW $49

A $2,000,000 GUARANTEE

That This $49 Typewriter Was $100—The Sales Policy Alone Is Changed, Not the Machine

The Oliver Nine—the latest and best model—will be sent direct from the factory to you upon approval. Five days' free trial. No money down. No salesmen need influence you. Be your own salesman and save $51. Over a year to pay. Mail the coupon now.

On March 1st, 1917, we announced The Oliver Typewriter Company's revolutionary plans. On that date we discontinued an expensive sales force of 15,000 salesmen and agents. We gave up costly offices in 50 cities.

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By eliminating these terrific and mounting expenses, we reduced the price of the Oliver Nine from the standard level of $100 to $49. This means that you save $51 per machine. This is not philanthropy on our part. While our plan saves you much, it also saves for us.

The entire facilities of this company are devoted exclusively to the production and distribution of Oliver Typewriters.

Over 600,000 have been sold. This is the same commercial machine used by the U. S. Steel Corporation, the National City Bank of New York, Montgomery Ward & Co., Morris & Co., Packers, the Pennsylvania Railroad, and a host of others.

Simplified Selling

Our new plan is extremely simple. It makes it possible for the consumer to deal direct with the producer.

The Identical Model

The Oliver Typewriter Company gives this guarantee: The Oliver Nine we now sell direct is the exact machine—our latest and best model—which until March 1st, 1917, was $100.

This Oliver Nine is a twenty-year development. It is the finest, the costliest, the most successful model that we have ever built.

More than that, it is the best typewriter, in fifty ways, that anybody ever turned out. If any typewriter in the world is worth $100 it is this Oliver Nine.

You may order from this advertisement by using the coupon below. We don't ask a penny down on deposit.

When the typewriter arrives, put it to every test—use it as you would your own. If you decide to keep it, you have more than a year to pay for it. Our terms are $3.00 per month.

You are under no obligation to keep it. We will even refund transportation charges if you return it.

Or if you wish additional information, mail coupon for our proposition in detail.

Don't Pay $100

Why now pay the extra tax of $51 when you may obtain a brand new Oliver Nine—a world favorite—for $49? Cut out the wasteful methods and order direct from this advertisement.

Or send for our remarkable book entitled, "The High Cost of Typewriters—The Reason and the Remedy." You will not be placed under the slightest obligation.

Canadian Price, $62.65

MAIL TO-DAY

THE OLIVER TYPEWRITER CO.,
1106 Oliver Typewriter Bldg., Chicago, Ill.

☐ Ship me a new Oliver Nine for five days' free inspection. If I keep it I will pay $49 at the rate of $3 per month. The title to remain in you until fully paid for.

My shipping point is .....

This does not place me under any obligation to buy. If I choose to return the Oliver, I will ship it back at your expense at the end of five days.

☐ Do not send a machine until I order it. Mail me your book "The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalogs and further information.

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Street Address .....

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THE OLIVER TYPEWRITER COMPANY
1106 Oliver Typewriter Bldg., Chicago, Ill.

NOTE CAREFULLY:—This coupon will bring you either the Oliver Nine for free trial or further information. Check carefully which you wish.

This Coupon Is Worth $51

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The Kodak Letter

The star in the window tells the story—their soldier is "over there."

The morning letter of cheer and hope has been written and with it pictures are going, simple Kodak pictures of their own taking that tell the home story,—pictures that will bring a cheery smile to his face, a leap of joy to his heart, that will keep bright the fire of courage in his soul as with the home image fresh in mind he battles for the safety of that home and for the honor of his flag.

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